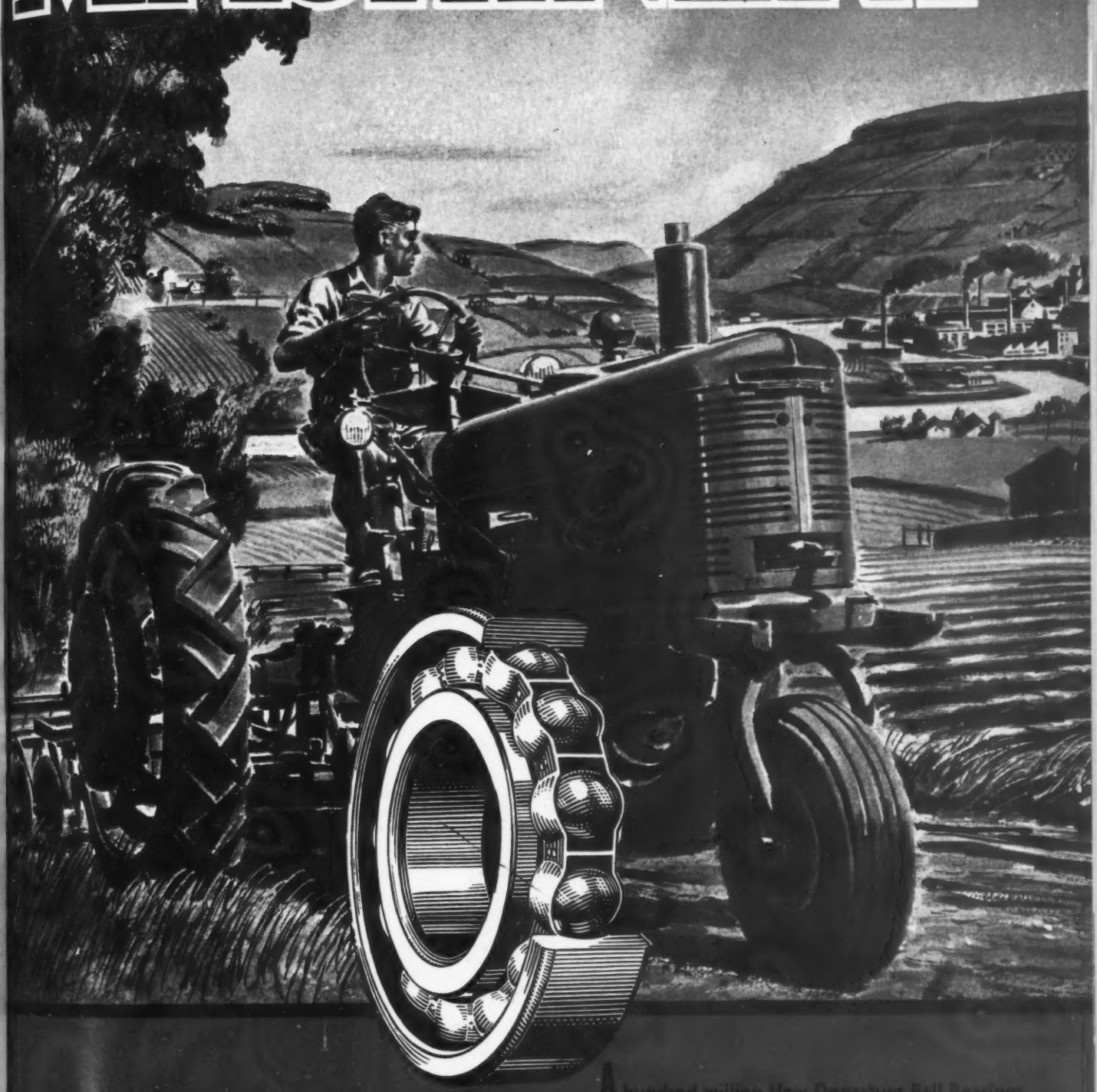
APRIL, 1944—FIFTIETH YEAR

MACHINERY



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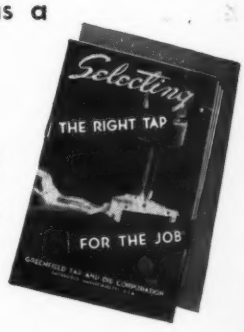

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DESIGN, CONSTRUCTION, OPERATION OF METAL-WORKING AND ALLIED EQUIPMENT

MACHINERY

APRIL, 1944

PRINCIPAL CONTENTS OF THIS NUMBER

A series of articles of especial interest to the designer will begin in the May number of MACHINERY. The leading article *What the Machine Designer Should Know About Electronics* will deal with the fundamentals of a subject that is now becoming of ever increasing importance in the mechanical field. Electronic devices are applicable in many branches of the machine building and metal-working field; many of these applications will be dealt with in this series of articles.

For Complete Classified Contents See Page 226

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How Can Industry Find Jobs for Disabled Veterans?

The Long Experience of the Ford Motor Co. in Providing Employment for Handicapped Workers Points the Way to the Solution of a Problem Now Demanding the Attention of All Industry

AS the war progresses, more and more men will be returning from the fighting fronts because of injuries and disabilities. They will be cared for in Government hospitals until they can return to civil life. At that time, industry must be prepared to find suitable jobs for those able to perform duties in our shops and factories. The problem of putting the disabled

A Veteran Who Saw Service in North Africa, and Whose Neck and Shoulder Muscles are Paralyzed Slightly, is Now a Riveter in the Ford Plant

Vol. 50 No. 8
MACHINERY
APRIL, 1944

Able to Use Only His Left Arm, This Man Fills His Place in the War Effort to the Fullest Advantage. He Inspects and Gages Aircraft Engine Parts in the Ford Plant

veterans to work is one that industrial management must tackle with intelligence and understanding. The task is a difficult one, but if handled in a systematic manner, these handicapped men will be able to return to society as self-supporting, self-respecting members.

The managers of industrial plants throughout the country realize the seriousness of the problem confronting them. They are willing to do their share; but because they have had no experience along these lines, they do not feel that they know how to approach the problem. Medium-sized and small firms, believing that unusual training facilities will be necessary, conclude that perhaps only the larger firms can meet this problem adequately. Many of the larger firms, in turn, are thinking in terms of elaborate facilities for handling the returning disabled veteran.

It is the object of this article to clarify this important matter by recording how the problem of employing disabled workers has been successfully handled for twenty years by one of the largest industrial organizations in the country.

The experience of this organization—the Ford Motor Co.—indicates that the chief requirement is not one of providing elaborate training facilities for these men, but rather one of carefully selecting, among the jobs available in each individual plant, those tasks that are suited to the capacity and previous training of each disabled worker. In other words, it is not so much a problem of fitting the worker to the job as it is of finding the job that fits the worker.

How the Ford Plan Originated

Some twenty years ago, Henry Ford instructed the managers of the various plants of the Ford Motor Co. to have surveys made in their respective communities to determine how many persons, in proportion to population, suffered from physical handicaps. When this survey was completed, Mr. Ford requested that, in each plant, approximately the same proportion of handicapped people should be employed.

It was found that about 10 per cent of the population in most industrial localities suffered from one physical disability or another; consequently, it has been the practice of the Ford Motor Co. to employ approximately that percentage of physically handicapped people in its various plants. Thus, among each thousand workers in the Ford plants there will be approximately a hundred who are not entirely physically fit.

At the present time, over 11,000 handicapped civilian workers are employed in the River Rouge plant alone, in addition to more than 3,000 returned service men. Among the civilian workers, 40 are totally blind; 365 are blind in one eye; nearly 300 are hardly able to see with one eye; and some 450 have too poor a vision to be able to do any kind of machine work where they would come in contact with moving parts.

There are 180 deaf mutes, and one man who is deaf, mute, and blind; 3 workers have both arms amputated, and 96 have lost one arm; 2 men have lost both hands, and 19 one hand; 10 have both legs amputated, and 175 have lost one leg; 6 have one foot amputated. There are also hundreds of cases of men and women crip-

pled in various ways, including 153 victims of infantile and other types of paralysis.

These figures are mentioned to indicate how serious are the handicaps under which these men and women labor, and to show that nevertheless they can be usefully employed in an industrial plant. No one of these workers is regarded, or has reason to regard himself, as receiving any favor. The Ford Motor Co. has made it distinctly understood that the employment of these men and women is not charity. Each of them is expected to give, and does give, full value for the wages received. The blind men, for example, receive from 95 cents to $1.15 an hour, and earn it, because they perform the same work as others not so handicapped. As someone expressed it: "The thought back of the Ford policy is charitable, but in practice it is not charity."

The Medical Transfer Department, which is a division of the medical department of the Ford River Rouge plant, is charged with the responsibility of determining the employability and proper placement of physically handicapped workers. This department determines which jobs can be filled best by persons lacking the use of some of their normal physical abilities or whose state of health is below par.

Blind men, for example, fit parts together and place them in boxes to be carried to other departments for insertion into engines. They also do inspection work where touch is the major factor and there is no dangerous machinery.

The company does not claim the whole credit for the success of these sightless men in their work; their fellow workers have been highly cooperative. They assist them, advise them, and, when necessary, instruct them. Furthermore, when any handicapped person, especially one who is blind, is hired by the company, a canvass is made to learn whether there are any other employes living in his neighborhood who drive

Totally Blind, This Automobile Mechanic, who Formerly Operated His Own Garage and Repair Shop, is Now Performing Skilled Mechanical Work in the Ford Plant. The Press can be Started Only when the Operator Steps back to Push the Starting Button. This Man is Able to Tear down and Re-assemble a Ford V-8 Engine

A Veteran who Served in North Africa and who was Thrown 50 Feet by a Bomb Explosion is Now Working as a Full-fledged Mechanic in the Ford Plant, after having been Discharged from the Army Hospital

to work. If there are, these assist the blind worker by providing transportation to and from the plant. Cooperation in this respect has always been found to be wholehearted.

The deaf mutes are employed in departments where there is little danger from overhead cranes, moving trucks, etc., since they are incapable of hearing warnings, bells, or signals. The company has never had any difficulties with deaf workers, and none has ever been involved in an accident.

Those who are crippled in one way or another are given work that can be performed sitting down or work that can be done by the use of one hand, or even without hands. Specific details as to work performed are given in the accompanying tabulation. This table is given merely to indicate the kind of work that it has been found feasible to have performed by workers with comparatively severe disabilities.

At the main River Rouge plant, there is a special entrance for these handicapped people, where they cross a street at grade level and are protected by traffic officers, warning signs, and signals. They are guided to the cars in which they travel. The blind men in some instances have trained dogs to lead them.

Procedure in Selecting Jobs for Handicapped Workers

In applying for work at the employment office of the company, all those physically handicapped are referred to the Medical Transfer Department. Conversation with the applicant and a physical examination usually determine what kind of work he would like and is best suited to do. One of the members of the department—a shop investigator—accompanies the applicant to the department decided upon as suitable.

The general foreman of that department is interviewed and the prospective employe's capabilities are explained to him. If a job is available that he can do and that seems to fit his mentality and previous training, and if it is one on which he will be able to earn the regular wages paid, he is placed in that job. If nothing suitable is available in the first department visited, the same procedure is followed in other departments until the applicant is placed.

In cases where the applicant has a serious physical disability, such as paralysis, deafness, blindness or poor vision, heart ailment, or loss of arms or legs, the foreman is requested not to transfer him to other work than that selected without first notifying the Medical Transfer Department. This request is made in writing. The object of this is clear. The man must not be transferred to hazardous work for which he may not be suited; accidents that might injure himself or others must be guarded against.

It should be noted that in all cases of hiring new handicapped employes, the investigator personally conducts the prospective employe to the department foreman, requesting that special care be taken of the man. If any special training is required for the work, the new worker receives that training on the job, and is instructed by the foreman or a fellow worker, just like any other new employe

Examples of Work Done by Disabled Employes in the Ford River Rouge Plant

Type of Disability	Number of Cases	Kind of Work Being Performed
One Arm Amputated	96	Tool-crib attendants and stock clerks; etchers; stampers of tools and materials; record clerks; inspectors; operators of simple machine tools; refitting of worn engines.
Both Arms Amputated	3	One man with both arms amputated wears artificial arms and delivers mail to various departments, a job that normally would have to be filled by an able-bodied messenger; one works as flag man at railroad crossing; and one as follow-up man on work in process in plant.
One Hand Amputated	19	Work similar to that of men with one arm amputated.
Both Hands Amputated	2	One is tool stock-room attendant; he hands out tools and places the record checks on the board. By means of a pencil attached to a strap around his wrist he writes out his own material requisitions and makes notes of tool shortages. He is also able to operate a typewriter. The foreman in charge considers him unusually efficient. Another man with both hands amputated is inspector of Pratt & Whitney engines, giving crankcases, bearings, caps, guides, and other parts visual inspection for nicks and other damage. He makes his own entries on inspection sheets, signs the tear-down and build-up records of the engines, and approves them for the test house. He has proved especially efficient on this job.
One Leg Amputated	175	These men do bench work, inspection, wiring, polishing, grinding, etc.; some work in a sitting position, while others, with the aid of artificial limbs, stand up while operating various machines.
Both Legs Amputated	10	These men do work where they can sit down—electrical wiring, repair of electrical instruments, bench assembly, and inspection. Some, with the aid of artificial limbs and at their own volition, do work that requires them to stand up at small presses or similar machines.
One Foot Amputated	6	The majority of these men have an artificial foot and work at production machines and at other mechanical employment, much the same as men without any handicap.
Blind in Both Eyes	40	The work these men are able to perform is astonishing. One man assembles a universal housing ball cap, involving fitting the two pieces together, inserting bolts and nuts, and clamping them. Other work performed by blind men involves the assembling of valves, the inspecting and gaging of front-axle bolts, and inspecting of parts requiring the gaging of external and internal diameters by limit gages, and the checking of a tapered hole with a limit feeler gage. One totally blind man, who, before becoming so afflicted, was an expert automobile mechanic, is capable of taking apart and reassembling Ford V-8 engines and of discovering and correcting faults in their operation. He also operates a press for assembling engine parts.

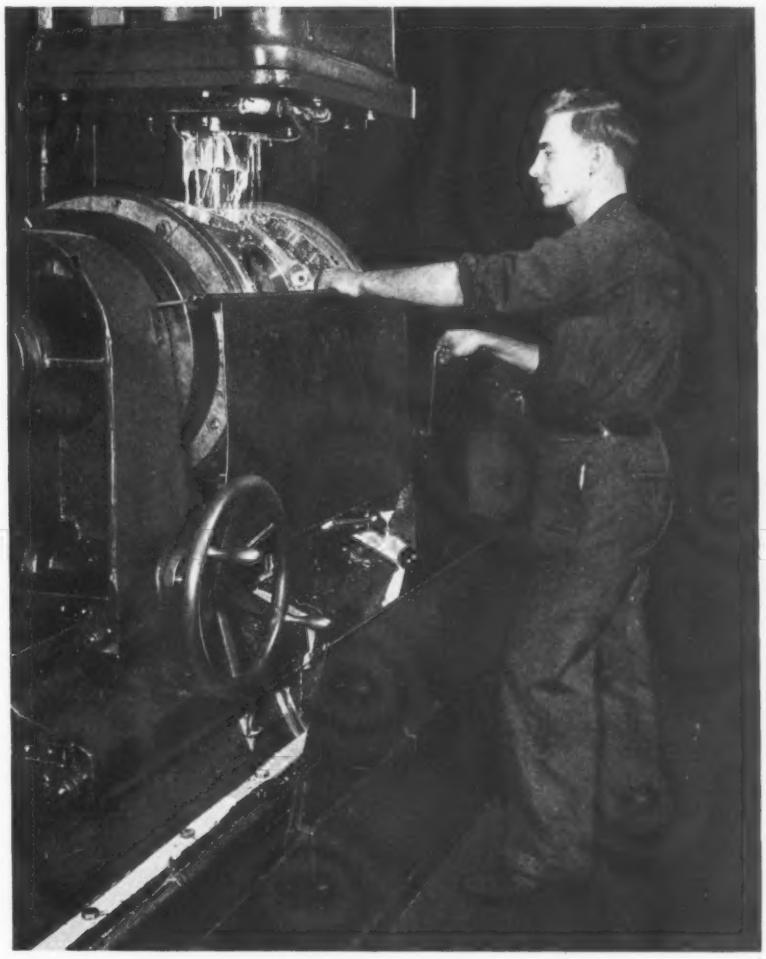
It is necessary that the shop investigator keep in touch with the handicapped worker after he has been placed in a job. Sometimes the worker will ask his foreman to be transferred to other work that may be too hazardous for him. A carefully planned checking-up system has been worked out to prevent this. Every employe in the plant is recorded in a file in the employment office. On the outside of the envelope that contains the record of disabled workers there is what is known as a "medical sticker," so that, in case of transfers, the fact of his physical disability will become apparent the minute the envelope is pulled out of the file.

Personality and Attitude of Men in Charge of Disabled Workers is All Important

From the procedure indicated, it is obvious that much depends upon the attitude of the man in charge of the Medical Transfer Department and the shop investigators who are handling the individual cases. These men must have broad vision, a sympathetic attitude, extensive knowledge of the plant and the work to be performed, a friendly attitue toward the handicapped workers, and the ability to make friends with the foremen in the plant.

In all, there are ten people assigned to the Medical Transfer Department at the River Rouge plant. Two men and one woman are classified as shop investigators. It is their duty to roam about the plant, picking out jobs that are suitable and available for handicapped workers. Three men are assigned to the duty of listening to suggestions and complaints. These suggestions are grouped according to departments, and are later investigated. One man handles compensation cases only. It should be noted that all of these men have an ability far beyond the ordinary in the art of dealing with people, whether it be the foremen or the workers. A

After having been Three Years with the Marines, during which Service He Contracted Malaria and Suffered from Bomb Concussions, This Veteran is Now Helping to Build Bomber Engines



Another Veteran, who was Honorably Discharged because of Shell-shock after Seventeen Months Service in the Army, is Back in the Ford Plant on the Job that He Left before Going into Service

plant physician and a staff of nurses handle pre-employment examinations.

To make the system successful, obviously, there are card indexes of all the physically handicapped. There is also a card index of every department in the plant, giving a brief description of the department, its location, the name of the foreman, the operations performed, the type of work handled, and the types of employes preferred. At a moment's notice, for example, the investigator can check whether in a certain department they have grinding machines, drilling machines, etc.; he can find out the weight of the work being handled, and what jobs may be available for workers with various types of handicaps. The plant physicians are also required to become thoroughly acquainted with all the jobs in the shop performed by men under their supervision. This necessitates that the doctors move around the plant accompanied by a safety inspector.

An important point to remember in connection with the successful employment of disabled workers in modern industry is the fact that the actual labor to be performed is more and more done by machines or other mechanical devices. "Skill" formerly possessed by the worker is now often transferred to the machine, and even inspection and gaging is often mechanically or electrically performed, requiring a minimum of physical effort on the part of the worker. This makes it easier for the disabled employe to fulfill duties that formerly would have been impossible for him to undertake.

The educational facilities provided by the Ford company are available to the handicapped workers, the same as to all other workers in the plant; hence, there is an opportunity for a man to develop his capacities along new lines and to lay the groundwork for advancement in the organization. As a specific example may be mentioned the case of a man who had lost one hand

as a machine operator; he gradually fitted himself to become a metallurgical engineer, and as such, now holds an important position in the organization.

Many employers have hesitated to engage disabled workers because they fear difficulties arising in connection with the workmen's compensation acts and a possible increase in accidents. On this point, Dr. Harley L. Krieger, medical director of the Ford Motor Co., expresses an encouraging opinion. He says that the disabled workers, in the vast majority of cases, cause no trouble either from the point of view of accident compensation, quality of workmanship, or quantity of production. He says that it is his impression that these men, knowing their disabilities, are less liable to accidents than normal workers, because the disabled man is more careful and will not take chances.

Handling the Employment of Returning Veterans

The rehabilitation of returned service men, discharged from the Army and Navy for medical reasons, is handled in the same way as the placing of any handicapped civilian employe. The returning soldiers with medical discharges are placed in two groups: (1) The "inactive" group, which includes those who have not seen overseas duty; and (2) the "active" group, which includes those who have been overseas. The terms "active" and "inactive" are used merely to indicate the military status of the discharged soldier.

In the first group—the inactive group—many of the medical discharges—in fact, the majority—are for common, everyday disabilities, which do not amount to very much in connection with industrial work, but which may be of considerable importance as far as the armed forces are concerned. For example, out of some 350 returned service men put to work up to a given date, about forty were discharged from the services because of flat feet. All that had to be done in such cases was to reinstate these men in their old jobs, if possible. If not, any job in the factory suited to the man's experience, except work requiring much walking, would be satisfactory. A soldier with flat feet may not be able to go on long marches, but generally speaking, he is 100 per cent fit in industry.

Among the same group of returned soldiers, there were forty-one whose discharge papers diagnosed their disability as "nervousness." This general diagnosis is not very enlightening. However, upon talking with many of these young men, it was found that they were not far from being physically normal. When these men were reinstated in their old jobs and surrounded with familiar names and faces—and with the familiar noises of the shop—no abnormal tendencies were apparent, as far as the medical department could ascertain. These men are fully self-supporting, they are resuming their normal place in society, and may be classed as wholly rehabilitated men. Generally speaking, the problem presented by the inactive group of returning soldiers is comparatively easy to handle; these men can be readily placed.

The soldiers returning from overseas are usually discharged because of a definite disability, which is quite frequently of a permanent character. These men have seen active service, they have been wounded and have remained in hospitals until their wounds have healed; now they present themselves for work. Jobs must be found for one-armed and one-legged men, for blind men, for shell-shocked men, and for men who have recovered from tropical diseases. They are handled in the same manner as similarly handicapped civilian workers.

Extreme care, however, is taken in placing them in a suitable job, and in many cases, it has taken several days to locate a job that seemed exactly right. Up to the beginning of the year, more than 150 men discharged from active duty had been re-employed by the River Rouge plant, in addition to over 2000 men who were classified in the inactive group. These were all former employes of the Ford company. In addition, over 1300 returning service men not formerly employed by the company had been placed in the various Ford plants.

The entire policy of the Ford Motor Co. in employing disabled people is predicated on the belief that no one is really handicapped as long as he or she has the courage to face his difficulties and the willingness to do his best. When these people have come to the Ford plants, they have been made welcome. They are self-sustaining, self-respecting members of the community, capable of taking care of themselves and looking to the future with confidence.

Bending Preformed and Extruded Sheet-Metal Sections

Use of Wrap-Forming and Cam-Bending Machines to Give Proper Contours to Airplane Structural Members of Extruded and Preformed Shapes

By THOMAS T. TOBIN
Production Design Engineer
Factory A
Lockheed Aircraft Corporation
Burbank, Calif.

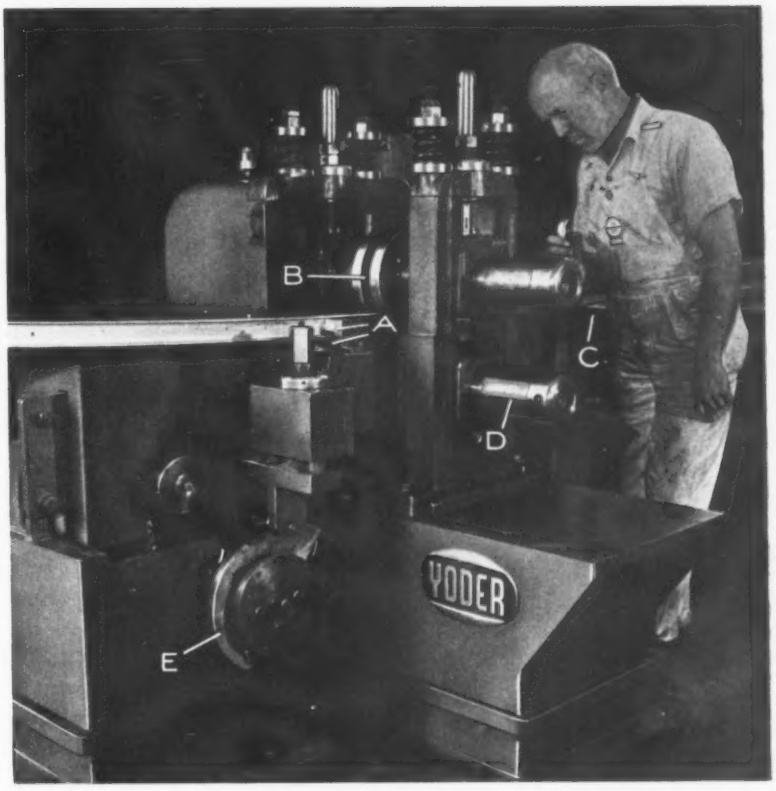


Fig. 1. Cam Type Bending Machine, Showing the Principal Functioning Elements

THE cam type bending machine is designed for bending preformed sheet-metal sections or extrusions to an arc or other contour in a vertical plane. The Yoder machine, shown in Fig. 1, consists essentially of a feed-table *C*, a starting shoe (not shown), upper and lower feed-rolls, indicated at *B* and *D*, upper and lower bending shoes *A*, and a shoe-actuating cam *E*. When needed, an attachment to exert pressure on the bending shoes for reverse bending is also utilized.

The sections to be formed are cut to length and inserted in the starting shoe, which guides them into the rolls. Both upper and lower rolls are power-driven, and are shaped to fit the cross-section of the part closely and to bear tightly on one flat surface, where pressure can be adjusted to prevent slippage on difficult forming operations. Provision is also made for exerting side spring pressure on vertical sections of parts to keep them from buckling.

Upon leaving the rolls, the part strikes upon the lower bending shoe, which is also shaped to fit the cross-section of the part being formed, as shown in Fig. 2. Two types of sections which have been given a slight curvature in this machine are seen in the foreground of the illustration. For forming to an arc, the shoe is held stationary while set at a definite position in relation to the rolls. Since this type of forming does not require any movement of the shoe, no actuating cam is needed.

When a contour other than an arc is required in one direction, a cam is utilized to raise the shoe at whatever rate is necessary to produce the desired contour. When a reverse or "S" curve is to be formed, two shoes must be provided, one above the other, to entirely enclose the part.

In making the reverse curve, the part is curved upward by pressure from the lower shoe exerted by means of the cam. The curve in the opposite direction is produced by pressure of the reverse bending attachment against the upper shoe, which forces both part and shoes

Fig. 2. Close-up View of Cam Type Bending Machine, Showing Upper and Lower Bending Shoes through which the Work-piece Passes. Two Types of Pieces are Seen in Foreground

downward, while at the same time maintaining the cam roller in contact with the cam.

Each job requires a special set of tools—that is, the rolls must be shaped to fit the cross-section of the part, and so must the bending shoes when the part is to pass between them.

The starting shoe is made of cold-rolled steel, finished smooth. The rolls are made of tool steel, hardened, ground, and polished. For short runs, cold-rolled steel rolls and shoes will give satisfactory service. The bending shoes are of the same material as the rolls, but should be hard chrome-plated to give maximum life. The cam is cold-rolled steel, 5/8 inch thick.

To form a circular part from rolled, extruded, or otherwise shaped sheet-metal stock, a starting shoe, a set of rolls, and a bending shoe are required. The same stock can be formed to a contour (other than an arc) in one direction by using the same tools as for forming a circular part, with the addition of a cam. In forming this stock to a reverse or "S" curve, a cam and an extra bending shoe to rest on top of the other shoe and enclose the piece are used, in addition to the tools required for circular forming.

The cam type bending machine has certain limitations which must be taken into account when planning for its use. The material to be formed must be either preformed sheet of constant cross-section or extruded stock. The machine is designed to form only in a vertical plane. However, by setting the bending shoe at an angle in relation to the rolls, a slight side bend can be produced.

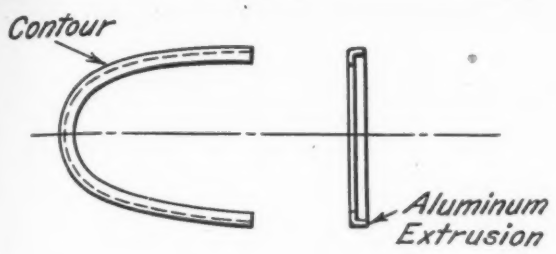
The maximum length of the blank is limited by the cam periphery. In the case of the machine illustrated, the maximum length is 20 feet. Sometimes two or more parts can be formed in one pass and later cut apart, or two parts can be formed side by side or back to back to equalize the pressure. Sections can be formed to a helix, similar to a coil spring, and can then be cut to length to form circular shapes in a subsequent operation. The minimum radius to which the material can be formed is limited by the size of the machine. Wrought aluminum in the S-O or annealed condition is formed more readily on this type of machine than that in the S-T or fully heat-treated condition.

Contours in which the flanges are stretched can be formed by this method more readily than contours in which the flanges are shrunk. No abrupt changes in contour are possible. Symmetrical sections are preferred, because the pressure on both sides of the axis of the piece is equalized and less difficulty is experienced in maintaining even feeding.

Closed-angle sections can be formed, provided they allow access for the rolls. Stainless-steel sections in the lighter gages can be formed, but these impose limitations which will not be touched upon here. The cross-section through a part after forming must be the same as before forming. In other words, the flange angles or any other dimensions cannot change. Examples of parts that can be formed, as well as of those that cannot be formed, on the cam type bending machine, are shown in Fig. 3. The parts shown are for aircraft.

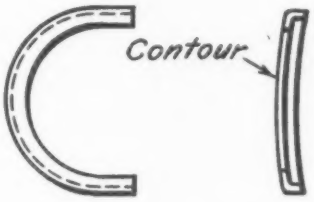
Capacities and Limitations of the Wrap-Former

The wrap-forming machine is used for processes similar to those for which the cam type bending machine is employed. Its capacities and limitations are somewhat different, however.



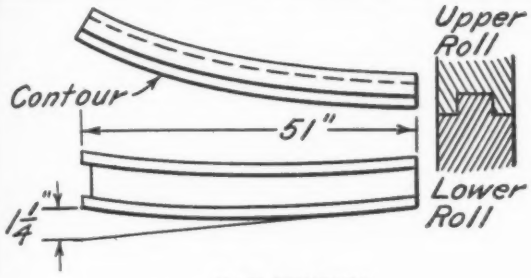
BULKHEAD REINFORCING SEGMENT

Tools Required: 1 starting shoe, 1 set of rolls, 1 upper and lower bending shoe, 1 cam.



TURRET SUPPORT RING

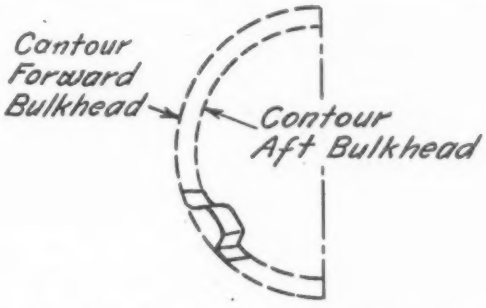
Cannot be formed on cam bender due to double curvature.



HAT SECTION

Tools Required: 1 starting shoe, 1 set of rolls, 1 set of bending shoes (top and bottom—due to side bend), 1 cam.

Note: Curved side bend is made by offsetting bending shoe.



HORIZONTAL FLOOR SUPPORT HAT SECTION

Cannot be formed on cam bender due to variation in flange angles.

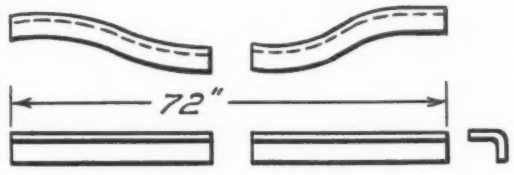
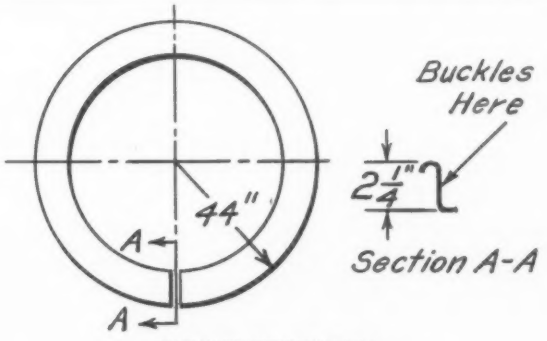


TABLE SUPPORT

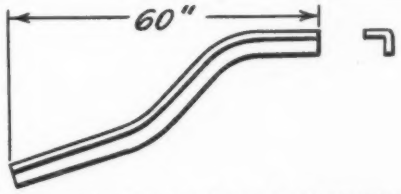
3 sets of parts to be formed from one 18 ft. long blank.

Tools Required: 1 starting shoe, 1 set of rolls, 1 set bending shoes (upper and lower), 1 cam—designed with 3 identical surfaces.



CIRCUMFERENTIAL

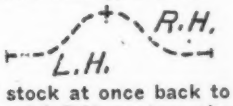
Excessive stretch in outer flange prohibits satisfactory tooling on cam bender.



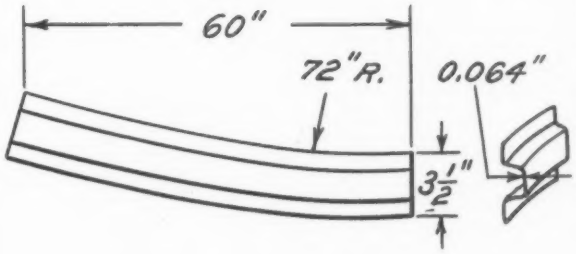
LEFT AND RIGHT KEELSON STIFFENERS

Two methods of forming, each requires 1 starting shoe, 1 set of rolls, 1 set of bending shoes (upper and lower), 1 cam.

1—



2—2 lengths of stock at once back to back makes 2 L.H. and 2 R.H. parts each pass.



HAT SECTION

Cannot be formed on cam bender due to side bend.

Fig. 3. At Left are Parts that can be Formed by Cam-bender; at Right, Those that Cannot

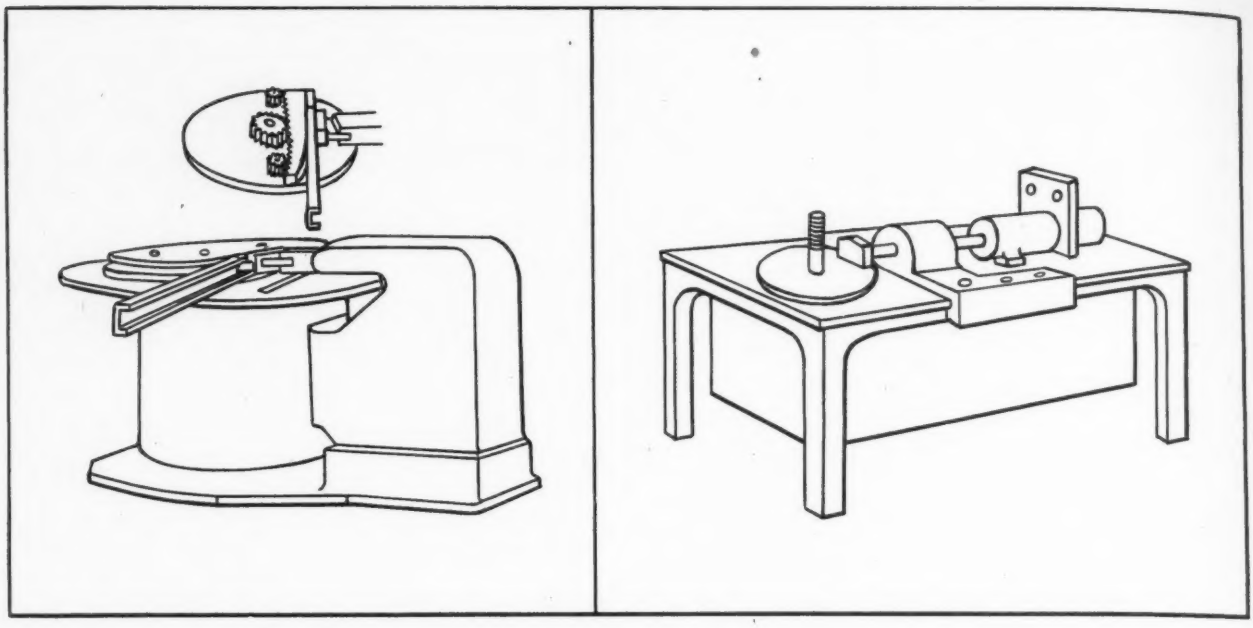


Fig. 4. (Left) Yoder Type Wrap-forming Machine. Detail View Shows Arrangement Used on This Machine for Rack Die and Gear Forming. Fig. 5 (Right) Vega Type Wrap-forming Machine

The wrap-forming machine has a horizontal power-driven round table on which dies of various designs may be mounted. A hydraulic cylinder causes a wiping shoe to form the parts by pressing the stock against the dies as it passes through the machine. Two types of wrap-forming machine are in use at the Lockheed Factory A—the Yoder type, shown diagrammatically in Fig. 4, and the Vega type, shown in Fig. 5.

In addition to the wrap-forming operations just mentioned, the Yoder type of machine is also adaptable to rack die and gear forming, which is used for long sections requiring but a slight curvature. For this type of forming, the table is fixed and a gear is attached to the driving shaft. A rack, built integral with the die, is driven by the center gear and pulls the part past the wiping shoe, as shown in Fig. 4.

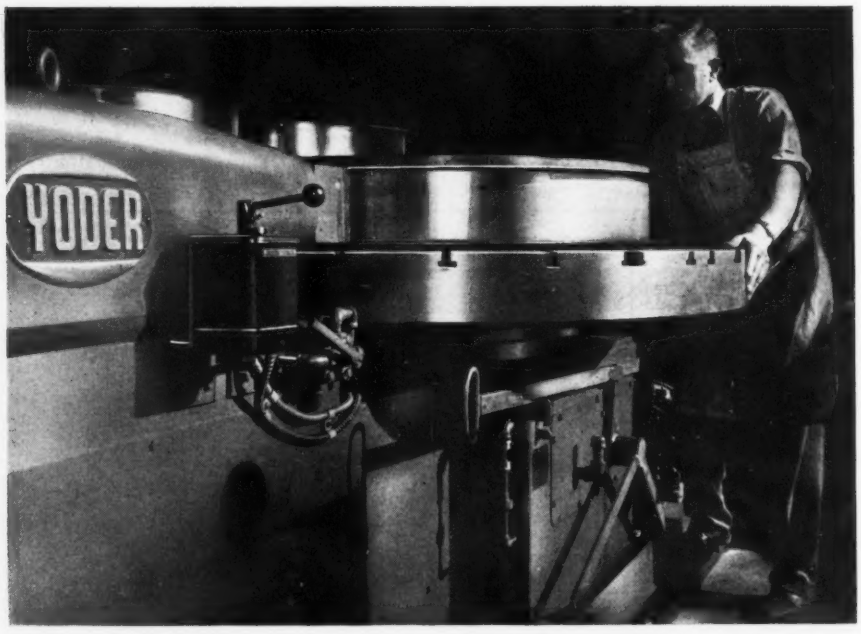
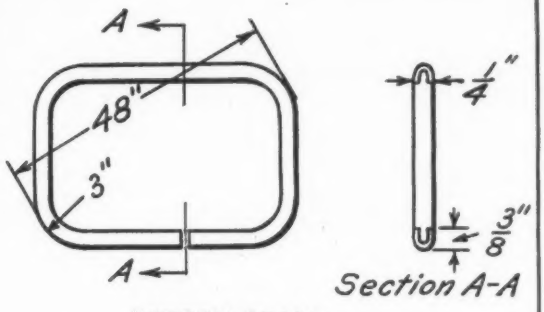
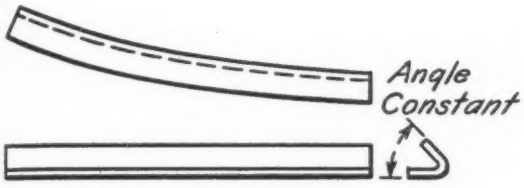


Fig. 6. Close-up View of Yoder Wrap-forming Machine, Showing Circular Turret Ring being Formed

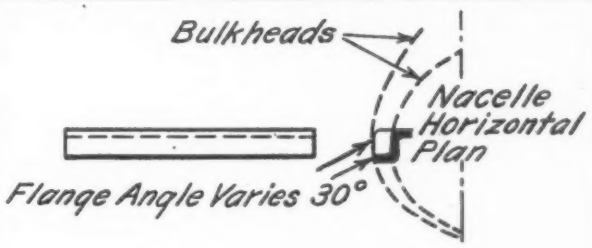


WINDOW FRAME
Material: 0.020" 24-ST Aluminum
Tools Required: Form Die and Wiping Shoe.

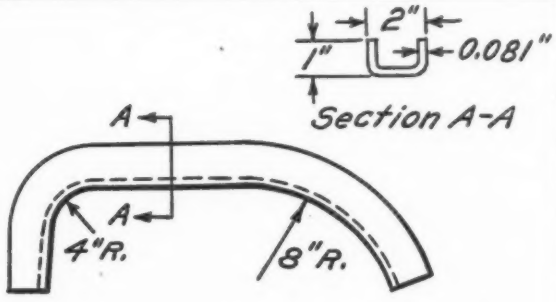
REINFORCING CHANNEL
Cannot be formed on wrap former due to reverse bend.



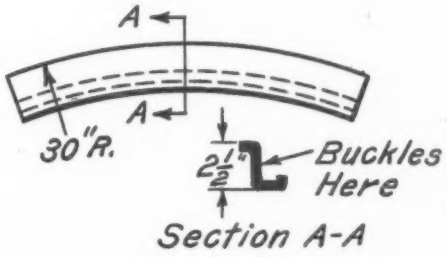
STIFFENER
Material: 0.051" 24-ST Aluminum
Tools Required: Form die and wiping shoe.



SUPPORT ANGLE
Material: 0.020" Inconel
This part cannot be formed on wrap former to fit contour exactly—flange angle can be varied approximately 20 degrees and part will spring into place in assembly.

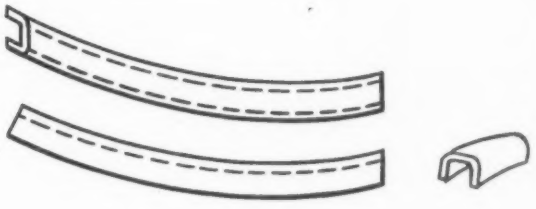


MOUNTING CHANNEL
Material: 24-ST Aluminum
Tools Required: Form die and wiping shoe.



CIRCUMFERENTIAL SEGMENT
Material: 0.040" 24-SO Aluminum
Cannot be formed on wrap former—material buckles—too thin for height.

HAT SECTION
Material: 0.064" 24-ST Aluminum
Tools Required: Rack type die and wiping shoe.

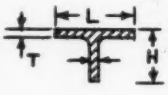


SUPPORT
Cannot be formed in wrap former due to double curvature.

Fig. 7. At Left are Parts that Can be Formed by Wrap-former; at Right, Those that Cannot

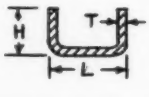
Minimum Radii Possible to Form on Cam-Bender or Wrap-Former

The forming is in one plane only. The arrows in each diagram indicate directions of curvature. The material is 24S-T aluminum. All dimensions are in inches.

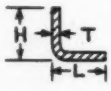


Extrusion

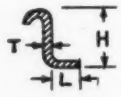
Dimensions			Cam-Bender		Wrap-Former	
L	H	T	A or B	C or D	A or B	C or D
3/4	3/4	0.062	6	10	3	6
1	1	0.050	7	10	4	6
1 1/4	1 1/4	0.050	15	15	14	8
1 1/2	1 1/2	0.064	18	24	14	12
1 3/4	2	0.125	25	30	24	16
2	2	0.094	36	36	24	24
3	2	0.125	36	72	24	72



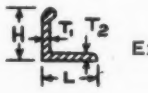
Dimensions			Cam-Bender		Wrap-Former	
L	H	T	A or B	C or D	A or B	C or D
3/4	1/2	0.040	6	No	3	See Note 1
1	1	0.064	7	No	4	
1 1/2	1	0.040	8	No	5	
1 1/2	1 1/4	0.081	18	No	8	
2	1 1/4	0.051	21	No	12	
2 1/2	2	0.081	51	No	29	
3	2	0.156	46	No	27	



Dimensions			Cam-Bender		Wrap-Former	
L	H	T	A or B	C or D	A or B	C or D
1/2	1/2	0.025	No	No	5	5
3/4	3/4	0.032	No	No	7	7
1	1	0.051	No	No	9	9
1	1	0.125	No	No	9	9
1 1/2	1	0.064	No	No	15	15
2	1 1/2	0.064	No	No	20	20
2	1 1/2	0.156	No	No	20	20

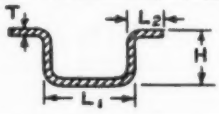


Dimensions			Cam-Bender		Wrap-Former	
L	H	T	A or B	C or D	A or B	C or D
5/8	3/4	0.040	No	24	15	6
5/8	1	0.032	No	24	18	6
5/8	1 1/4	0.040	No	24	20	6
13/16	1 1/4	0.064	No	30	20	9
1	1	0.032	No	36	18	10
1	1	0.051	No	36	18	10
1 5/16	1	0.032	No	42	18	12

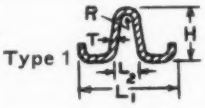


Extrusion

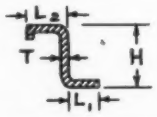
Dimensions				Cam-Bender		Wrap-Former	
L	H	T_1	T_2	A or B	C or D	A or B	C or D
5/8	5/8	0.040	0.040	6	6	3	3
13/16	13/16	0.050	0.050	6	6	3	3
1	3/4	0.050	0.050	6	7	3	4
1	1	0.090	0.090	8	8	5	4
1 1/4	7/8	0.172	0.125	10	10	6	5
1 1/2	1	0.100	0.070	10	24	6	6
1 3/4	1	0.093	0.093	10	36	6	12



Dimensions				Cam-Bender		Wrap-Former	
L_1	L_2	H	T	A or B	C or D	A or B	C or D
1	5/8	1	0.040	16	No	12	See Note 2
1 1/2	3/4	1 1/4	0.064	36	No	30	
2	3/4	1 1/2	0.081	42	No	36	
2	3/4	2	0.064	No	No	66	
2 1/2	3/4	2 1/4	0.081	No	No	78	
3	3/4	2 1/2	0.064 to 0.125	No	No	144	
3	3/4	3	0.156	No	No	240	



Type	Dimensions					Cam-Bender		Wrap-Former	
	L_1	L_2	H	T	R	A or B	C or D	A or B	C or D
1	1 3/4	3/16	7/8	0.040	3/32	30	No	6	See Note 1
1	2 3/4	1 1/8	1 1/2	0.051	13/32	48	No	18	
1	3 1/2	1 1/2	2 1/8	0.091	1/2	No	No	40	
2	1 1/2	3/4	5/8	0.032	3/16	24	No	4	
2	2 3/8	3/4	1	0.040	3/16	30	No	6	
2	2 1/2	1	1 11/16	0.040	9/32	48	No	24	
2	2 7/8	1 1/8	1 15/16	0.051	5/16	No	No	40	



Dimensions				Cam-Bender		Wrap-Former	
L_1	L_2	H	T	A or B	C or D	A or B	C or D
7/16	7/16	1 1/2	0.025	No	24	24	12
7/16	7/16	1 1/2	0.040	No	24	24	9
7/16	7/16	1 1/2	0.064	No	24	24	9
7/16	7/16	1 3/4	0.040	No	24	30	9
15/32	5/8	2	0.032	No	24	48	12
15/32	5/8	2	0.051	No	24	48	12
3/4	3/4	2 1/4	0.051	No	24	72	15

Note 1: Minimum curvature is an arc, the chord of which is 12 feet and the altitude 3 inches.
Note 2: Minimum curvature is an arc, the chord of which is 16 feet and the altitude 3 inches.

With either the Yoder or Vega machine, the parts to be formed, in every case, must be clamped to the die. The section of the part so clamped is later scrapped. Pressure is applied to the wiping shoe, and the die and part are moved past it to form the required shape. When the forming is complete, the machine is stopped, pressure on the wiping shoe is released, and the part is unclamped and removed from the die. Fig. 6 shows a section being formed to a round contour on the Yoder type of machine.

With the gear and rack type of arrangement, the machine can be stopped at the end of the stroke, and the part removed and replaced by a new blank. The machine can then be reversed to form another part on the return stroke.

One die and one wiping shoe are required for each different part. The same shoe can be used for other parts if the cross-section is the same. Some spring-back will necessarily be developed for each type of part. On the wrap-former, however, this spring-back is less than that which occurs when other methods of forming are used. This is due to the fact that the neutral axis of the material is brought closer to the inside of the bend by the stretching and wiping action of the machine. With the rack and gear method, the forming die must be attached to the rack. This unit is driven by a gear mounted on the table drive-shaft. The table itself does not turn, but holds idler gears to guide the rack.

The dies are made of cold-rolled steel, Kirksite, Masonite, or other suitable material. The wiping shoes are made of hardened, ground, and polished tool steel for forming aluminum sections, and of aluminum bronze for forming steel.

The parts to be formed must either be made of preformed sheet of constant cross-section or they must be extruded. Tubing or closed sections can also be formed without using hydraulic or air pressure when a simple circular shape is desired. The pressure will vary with the material and shape of the part. Too much pressure causes excessive deformation and warpage after the part has been removed from the machine. The wrap-former can also be used to form tubing and closed sections into helices within the limits of the shoe. For this purpose, a mandrel is used in the tube to guide it. A guide shoe of brass, or even of wood, is also desirable for use in guiding the part between the shoe and the die. This helps to prevent slippage.

Forming can be done only in a horizontal plane, with the exception of a plus or minus variation of 10 degrees allowed by the wiping shoe. Symmetrical cross-sections are preferred. Examples of parts that can be formed, and also of parts that cannot be formed, on the wrap-forming machine are shown in Fig. 7. These parts are for aircraft.

With the Yoder rack die method, the maximum length of blank is 20 feet. The maximum diameter of the die used on the Yoder type machine is 48 inches, and on the Vega machine somewhat less. The maximum stroke of the wiping shoe cylinder is 12 inches on the Yoder and 30 inches on the Vega type of machine.

Left- and right-hand parts, such as angles, can be formed in pairs when it is possible to place them in the machine back to back. Closed-angle sections can be formed if they allow access for the wiping shoe. Reverse ("S") or concave curves cannot be formed on wrap-forming machines in one operation, due to tension between the clamped end and the wiping shoe. If such curves were attempted on this type of machine, the part would be pulled away from the die.

S-O (annealed) aluminum stock is usually preferred to S-T (fully heat-treated) stock, due to the greater spring-back of the latter. S-T stock is usually specified, however, to eliminate the need for heat-treatment and subsequent straightening. The cross-section through a part after forming must be the same as before the operation. This means that flange angles, etc., cannot change during the process (except for the plus or minus 10 degrees previously mentioned).

In comparing the cam type bending machine with the wrap-forming machine, it should be noted that production is more rapid on the cam-bender, but that the tools for the wrap-former are less expensive. The cam-bender will form reverse or "S" curves, while the wrap-former will not. The cam-bender will also form helices, while the wrap-former is more limited in this type of work. On the other hand, the wrap-former can form smaller radii, and is suitable for forming aircraft window frames, door frames, etc., where the bends are too sharp for the cam-bender. The minimum radii of curvature that the cam-bender and wrap-former can form for different sizes and shapes of working material are given in the accompanying table.

Editorial Comment

Bureaucrats and demagogues to the contrary, the competence and speed of the war production job done by American industry has been a major factor in the shift of our war operations from defensive action to victorious offense. When peace comes, industry again will be put to the test; and of its many problems, one of the most appealing, as well as important, will be the rehabilitation and re-employment of veterans who have been crippled and disabled as a result of their war service.

Twenty-five years ago, this job was badly fumbled. The least that can be done for the men who have sacrificed so much is to make certain that they will be well cared for and that they will be given an opportunity to make something of their lives. The present relatively small trickle of disabled men returning from active service is, unfortunately, no safe indication of what we may expect in the future. The real fighting has hardly more than begun. When the big-scale engagements take place, the casualties are certain to be heavy, and many will return home crippled and disabled. Now is the time to prepare for that situation.

New Horizons for Returning Crippled Veterans

It is a dangerously false assumption to suppose that the Federal Government can take complete care of the disabled and crippled veterans, from start to finish. It is wholly wrong to think of this as exclusively the Government's job, about which no one else can do anything and with which, as business and industrial managers, we need not concern ourselves. Vigorous measures have already been undertaken by various Government agencies; but however well planned and executed, Government operations can carry only up to the "job line." Industry and business must be ready to take over and to find the kind of jobs that these men can perform.

Fortunately, experience in solving the problem of the disabled worker is not lacking. Several of our large corporations have for many years made it a practice to employ disabled and handicapped civilian workers in large numbers. Others are now organizing to properly handle this problem, and to find useful occupations for returning crippled veterans.

Industry Can Find Worthwhile Jobs for Disabled Men

Unfortunately, the number of concerns that have done this is not as large as it ought to be. This is partly because it is quite generally assumed that the job is one that can only be properly undertaken by large organizations. This is a mistake. There is opportunity for all—small and large—to participate; and there is a need for all. Participation must be nation-wide if the disabled veterans are to be given employment, as they should be, at places close to their homes.

The reason why all concerns, small or large, *can* participate is simple: The rehabilitation and employment of the physically handicapped is not nearly as difficult a matter as many have assumed. The leading article in this number of MACHINERY, "How Can Industry Find Jobs for Disabled Veterans?," records the experience of one of our largest industrial organizations in handling the employment of disabled workers for twenty years. A study of the methods of this company will show that the problem is quite simple in principle, requiring chiefly good common sense, careful individual study, and intelligent selection of jobs to fit individual cases.

All Concerns, Large and Small, Can Do Their Share

The job can be done—and properly done—by even the smallest concerns. The important thing is to take the small amount of trouble necessary to do it in the *right* way. To provide new horizons for the crippled veterans, we must make plans *now*.

Tool Engineers Hold Annual Meeting

TRUE to the pattern set for its conventions, the annual meeting of the American Society of Tool Engineers, held at the Bellevue-Stratford Hotel, Philadelphia, Monday and Tuesday, March 27 and 28, was unusually well attended by tool engineers from all parts of the country. A comprehensive technical program had been planned for the various sessions. Despite the number of subjects included, the technical discussions were scheduled in such a manner that the program was covered in two days.

One session, held Monday morning, consisted of the presentation of a series of papers which discussed all the factors relating to the planning and execution of a production program for a war product. These papers, presented by the heads of a large industrial organization, dealt with engineering, planning for production, tooling, actual foundry and machining production, and inspection methods for a specific war product. Thus, a complete picture of all the problems involved was obtained by the engineers attending the meeting.

An entire session was devoted to new developments in surface-finishing methods, with particular stress on honing methods. Papers were presented by Kirke W. Connor, of the Micromatic Hone Corporation, Detroit, Mich., and A. F. Hasty, of the Sunnen Products Co., St. Louis, Mo.

An evening session was scheduled for Monday, which dealt with the manufacturing, tooling, and personnel problems involved in the manufacture of a war product. At this session, William Jack, of Jack & Heintz, Cleveland, outlined the principles on which his company has based its production achievements.

The subject of the Tuesday morning session was "Electronics as Applied to the Machine Tool Industry." This session was in the form of a symposium. One paper presented the point of view of the electronic equipment builder and two papers were prepared by engineers connected with the machine tool industry. G. A. Caldwell, of the Industry Engineering Dept., Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., read the first of the three papers, and the other two were presented, respectively, by R. A. Cole, experimental engineer of the Grinding Machine Division of the Norton Co., Worcester, Mass., and by B. T. Anderson, electrical engineer of the Sundstrand Machine Tool Co., Rockford, Ill. The latter papers dealt with electronic controls as applied to grinding and milling machines.

The Tuesday afternoon session comprised a discussion of some machining processes in which there has been rapid progress during the war—fly-cutter milling and broaching.

The meeting was brought to a close Tuesday evening with the annual dinner, at which John H. Van Deventer, editor of the *Iron Age*, was the principal speaker. His subject was "The Tool Engineer and the Post-War World." The president of the American Society of Tool Engineers, Ray H. Morris, presided at the dinner, and past-president T. B. Carpenter acted as toastmaster. The new officers, whose election will be referred to in the May number of MACHINERY, were also installed on this occasion.

In view of the character of some of the subjects discussed and their bearing upon the war equipment manufacturing program, admission to the technical sessions was limited to those who had registration badges.

National Tool and Die Manufacturers Association

AN organization known as the National Tool and Die Manufacturers Association was formed last fall for the purpose of bringing together the numerous manufacturers throughout the country who are engaged in the design and building of jigs, fixtures, dies, tools, gages, etc., for mass production in other plants. The Association will deal with many problems that are common to those engaged in this industry, which consists of about 4000 comparatively small shops, each employing from five to sixty men in normal times. Only the exceptional shops are larger than this.

The headquarters of the Association are located in the Southern Bldg., Washington, D. C. M. W. Rowell, formerly with the Chain Belt Co., Milwaukee, Wis., and the Sommer & Adams Co., Cleveland, Ohio, is general manager. At the organizing meeting, L. A. Sommer, president of the Sommer & Adams Co., was elected president; Richard F. Moore, president of Moore Special Tool Co., Inc., Bridgeport, Conn., first vice-president; Willis G. Ehrhardt, president of the Ehrhardt Tool & Machine Co., St. Louis, Mo., second vice-president; Harry V. Anderson, president of the Crescent Mfg. Co., Rockford, Ill., secretary; and H. F. Jahn, president of the B. Jahn Mfg. Co., New Britain, Conn., treasurer.

Production Schedules Met by

Comprehensive Survey of Causes of Motor Failure, together with Definite Instructions on the Steps to be Taken to Avoid Them — First of Two Articles

THE best insurance against shut-downs and interrupted production is proper maintenance of the motors that power the machines. A motor that is operated without inspection or that receives little or no maintenance may soon fail, and an unnecessary production delay will result until repairs are made. If a motor is so badly damaged or abused that it must be replaced by a new one, the production of two machines is affected—namely, the machine on which the motor failed and a new machine on which the replacement motor could have been used.

Since no one can definitely predict how long this war will last, every motor, new or old, should be maintained according to certain prescribed instructions to insure that it will operate for a maximum period of time without trouble.

The ideal motor maintenance program aims at preventing breakdowns rather than repairing broken parts, and this involves periodic and systematic inspection. In inaugurating a maintenance program, a thorough survey of each motor installation should be made and a systematic inspection and maintenance schedule established and enforced. Records must be kept consistently in accordance with the schedule selected. Several excellent record systems have been developed and reduced to printed form, so that it is not necessary to go to the trouble and expense of devising an individual system.

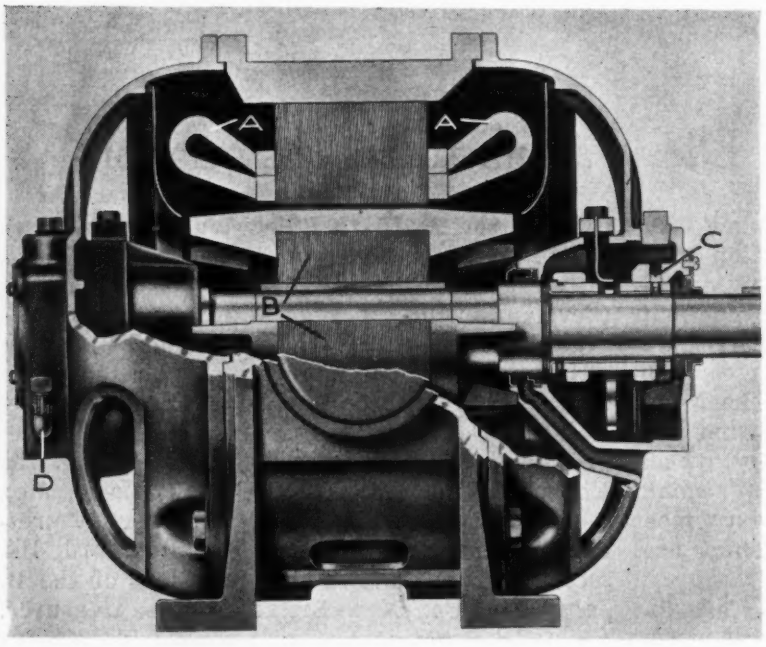
Prevention of breakdowns may be helped by a thorough analysis of the equipment involved. For example, if the difficulty is the frequent tripping of an overload relay, it may be that the installation of a different type of relay with a protecting thermostat on the motor will enable the motor to carry the load without an injurious rise in temperature.

Maintenance Schedules Should Include Systematic Inspection

It is impossible to give any hard and fast rules for frequency of inspection. The following suggestions are based on average conditions.

Once a week check the oil level in the bearings and see that the oil-rings are moving freely. Check the temperature of the motor bearings and primary iron with the hand. Sniff the warm air coming from open motors. The fumes emanating from overheated insulation are unmistakable.

Once a month check brush-holders, brushes, and shunts. Also, blow out the motor with compressed air every month.



Cutaway View of Alternating-current Squirrel-cage Motor; A, Stator Coils; B, Squirrel-cage Rotor; C, Sleeve Bearings; D, Oil Overflow and Filler Plug

Systematic Motor Maintenance

By D. W. McGILL, Application Engineer, Machinery Electrification Section
and W. W. McCULLOUGH, Maintenance Engineer
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Once a year check the air gap with a feeler gage. Check the insulation resistance with a megger. Check the line voltage with a voltmeter, and the load with an ammeter. Clean out and replace the grease in ball and roller bearings. Check renewal parts stock in the light of the past year's experience.

Every two years dismantle the motor. See that all windings are tight. Replace loose wedges and loose bands before dipping in varnish and baking. Inspect commutators and commutator connections. At intervals of about two years in average service, or during general overhaul periods, remove the bracket and wash out the bearing housing, using hot kerosene oil and compressed air, if available. Sleeve bearings require no flushing.

Faulty Bearings Cause Most Motor Failures

All motors depend upon a mechanical assembly of some sort for the transformation of electrical energy into mechanical energy or work. The bearings are a very important link in this mechanical assembly. Bearing troubles probably cause more motor shut-downs, delay, and expense than any other cause. This is not surprising when it is remembered that bearings are often affected by poor foundations, misalignment, vibration, thrust from couplings, dirt, too much or too little lubrication, and wrong lubricant.

Proper Lubrication a Basic Requirement

The first requirement of successful bearing operation is lubrication. This entails more than just an adequate supply of lubricant; and lubricant, the bearing design, and its condition must be correct.

The maximum safe temperature for bearings under normal operating conditions is considered to be 40 degrees C. (72 degrees F.) above the surrounding room air. At this temperature, a bearing feels comfortably warm to the hand. Assuming proper mechanical condition of the bearing, whether sleeve or ball, and the bearing assembly, and also assuming that proper lubricants are used, temperatures above a 40-degree C. rise call for immediate investigation.

Lubrication of Sleeve Bearings

In a sleeve bearing, the oil adheres to the shaft and is dragged along by the rotation of the shaft so as to form a wedge-shaped film between the shaft and the bearing. This film of oil carries the load and prevents metal-to-metal contact. So long as this film is established and maintained, there is no metal-to-metal contact in the bearing while the shaft is rotating, and, therefore, no perceptible bearing wear.

Two outstanding considerations govern the maintenance of sleeve bearings. The first is to insure the existence of the oil film, once rotation has begun. *Use the right oil.* The second is to minimize the destructive effects of metal-to-metal contact when the film is lost, either by accident or during the starting period. *Use the right babbitt.*

For sleeve bearings, proper maintenance keeps the oil well filled to the proper level and the oil-

Oiling the Motor Regularly is Essential to Long Bearing and Shaft Life, but Too Much Oil May Get into the Motor Windings and Cause Deterioration of the Insulation

After Eleven Years of Severe and Continuous Service, a Bearing Wear of Less than 0.0015 Inch—Thanks to Proper Lubrication and Intelligent Maintenance

rings turning freely. New oil should be added only when the motor is at rest to prevent overfilling of the reservoir. Oiling of bearings is more often overdone than underdone. Sleeve bearings that require frequent refilling, so that oil leaks on the stator windings, should be replaced with sealed sleeve type brackets and bearings.

It is well known that oil-rings generally carry far more oil than is necessary for proper lubrication of the bearing. When running, most of the oil is carried on the outside diameter of the rings by centrifugal force. This excess oil causes splashing and spray inside of the bearing housing. Air currents passing through the housing pick this spray up and deposit it on the motor windings. Sealing the bearing against the entry of air currents is, therefore, necessary, and is accomplished in all modern designs by close tolerances, felt seals, and air bypasses to offset the blower action of rotating parts.

The purpose of the felt washer in these seals, often misunderstood, is to keep out air and dirt. In itself, it has little value in preventing leakage of oil, once it becomes oil-soaked. Bearing wear, which results in radial movement of the shaft, spoils the effectiveness of the bearing seals. Replace all felt seals at the same time when sleeve bearings are being replaced. These felt seals should be ordered from the manufacturer of the motor. If it is necessary to make them in an emergency, use high-grade felt not less than 1/4 inch thick before compression. Make the inside diameter of the washer the same as that of the shaft or slightly less. Cut the felt true, with edges at right angles to its facing surfaces. Oil leakage is generally aggravated by high temperatures. Keep bearings as cool as is practicable, and use an oil that does not foam easily.

Factors in Ball-Bearing Lubrication

Ball bearings are being widely used in motors, particularly in the totally enclosed and fan-cooled types. In a sleeve bearing, as just explained, the shaft, when in motion, is separated from the bearing by the oil film. In a ball bearing, a series of steel balls act as the separating medium, both when the motor is stationary and when it is running.

Recommended Maintenance Practice

Keep motor off line when not needed.	Saves unnecessary wear of brushes, commutator, and bearings; saves lubrication.
Do not leave field circuit excited unless motor has been especially designed for this type duty.	Check temperature of shunt fields with thermometer to see that temperature does not exceed 90 degrees C. When field must be excited, caution maintenance men to be sure field circuit is opened before working on the motor.
Keep motor clear of metal dust or cuttings that can be drawn into windings and pole pieces.	Magnetic attraction will draw metal parts into air gap and damage windings.
Reassembling of motor.	Be sure to retain proper air gaps in motor by checking bore of pole faces before dismantling. Reassemble, replacing poles and liners in their original position.
Note wearing parts and parts frequently replaced to determine anticipated repairs.	Carry in proper store-room stock of replacement parts. Make survey of standard repair parts to avoid duplication of parts to be carried.

To keep the steel balls uniformly distributed around the bearing, a cage or retainer is used, each ball having its own pocket. The balls have rolling contact with the raceway, but sliding contact with the surface of the retainer. This means that lubrication is necessary.

Most ball bearings used in horizontal motors are grease-lubricated, although some supplied with vertical motors use oil. Follow the advice of the motor manufacturer in selecting a suitable grease. Soda-base soap greases are usually preferred on account of their high melting point and their stability. They mix readily with water, however, and blend to form an emulsion.

Carelessness in allowing containers to remain open often causes trouble from abrasive dirt.

Maintenance Checking Chart for Alternating- and Direct-Current Motors

Trouble	Cause	What to Do
Hot Bearings	Bent or sprung shaft	Straighten or replace shaft.
	Excessive belt pull	Decrease belt tension.
	Pulley too far away	Move pulley closer to bearing.
	Pulley diameter too small	Use larger pulleys.
	Misalignment	Correct by realignment of drive.
Sleeve Bearings	Oil-grooving in bearing obstructed by dirt	Remove bracket or pedestal with bearing and clean oil-grooves and bearing housing; add new oil.
	Bent or damaged oil-rings	Repair or replace oil-rings.
	Oil too heavy	Use a recommended lighter oil.
	Oil too light	Use a recommended heavier oil.
	Insufficient oil	Fill reservoir to proper level in overflow plug with motor at rest.
	Too much end thrust	Reduce thrust induced by driven machine or supply external means to carry thrust.
	Badly worn bearing	Replace bearing.
Ball Bearings	Insufficient grease	Maintain proper quantity of grease in bearing.
	Deterioration of grease or lubricant contaminated	Remove old grease, wash bearing thoroughly in kerosene, and add new grease.
	Excess lubricant	Reduce quantity of grease. Bearing should not be more than half filled.
	Heat from hot motor or external source	Protect bearing by reducing motor temperature.
	Overloaded bearing	Check alignment, side thrust, and end thrust.
	Broken ball or rough races	Replace bearing; first clean housing thoroughly.
Oil Leakage from Overflow Plugs	Stem of overflow plug not tight	Remove, re-cement threads, replace, and tighten.
	Cracked or broken overflow plug	Replace the plug.
	Plug cover not tight	Requires cork gasket, or if screw type, may be tightened.
Motor Dirty	Ventilation blocked, end windings filled with fine dust or lint	Clean motor will run 10 to 30 degrees cooler. Dust may be cement, sawdust, rock dust, grain dust, coal dust, etc. Dismantle entire motor and clean all windings and parts.
	Rotor windings clogged	Clean, grind, and under-cut commutator. Clean and treat windings with good insulating varnish.
	Bearing and brackets coated inside	Dust and wash with cleaning solvent.
Motor Wet	Subject to dripping	Wipe motor and dry by circulating heated air through motor. Install drip or canopy type covers over motor for protection.
	Drenched condition	Motor should be covered to retain heat and the rotor position shifted frequently.
	Submerged in flood waters	Dismantle and clean parts. Bake windings in oven at 105 degrees C. for twenty-four hours or until resistance to ground is sufficient. First make sure commutator bushing is drained of water.

Trouble Correction Chart for Alternating-Current Motors

Trouble	Cause	What to Do
Motor Stalls	Wrong application	Change type or size. Consult manufacturer.
	Overloaded motor	Reduce load.
	Low motor voltage	See that nameplate voltage is maintained.
	Open circuit	Check for blown fuses. Check overload relay, starter, and push-button.
	Incorrect control resistance of wound rotor	Check control sequence. Replace broken resistors. Repair open circuits.
Motor Connected but Does Not Start	One phase open	See that no phase is open.
	Motor may be overloaded	Reduce load.
	Rotor defective	Look for broken bars or rings.
	Poor stator coil connection	Remove end bells; locate with test lamp.
Motor Runs and Then Dies Down	Power failure	Check for loose connections to line, to fuses, and to control.
Motor Does Not Come up to Speed	Not applied properly	Consult supplier for proper type.
	Voltage too low at motor terminals due to line drop	Use higher voltage on transformer terminals or reduce load.
	If wound rotor, improper control operation of secondary resistance	Correct secondary control.
	Starting load too high	Check load motor is supposed to carry at start.
	Low pull-in torque of synchronous motor	Change rotor starting resistance or change rotor design.
	Open circuit in secondary	Check that all brushes are riding on rings. Check secondary connections. Leave no leads poorly connected.
	Broken rotor bars	Look for cracks near the rings. A new rotor may be required as repairs are usually temporary.
	Open primary circuit	Locate fault with testing device and repair.
Motor Takes Too Long to Accelerate	Excess loading	Reduce load.
	Poor circuit	Check for high resistance.
	Defective squirrel-cage rotor	Replace with new rotor.
	Applied voltage too low	Get power company to increase voltage tap.
Wrong Rotation at Start	Wrong sequence of phases	Reverse connections of motor or at switchboard.

Ball bearings that are not in good condition can usually be detected by undue heating or by unusual noise. Broken or nicked balls cause rapid destruction of the bearing. They can be detected by the "clicks."

If the conventional 40-degree C. rise above the surrounding air is exceeded, look for an overfilled bearing, since the first result of overgreasing is heating, caused by churning of the grease. The general rule is that the housing should not be over half full. Clean the old grease from the bearing and from the housing once a year and replace it with new grease. Average service is assumed.

After it is dismantled, the bearing should be carefully wrapped in clean cloth or paper to protect it from outside dirt. Remove all old grease from the housing, and clean the housing and the bearing either in Stoddard solvent or in carbon tetrachloride. This is not an easy operation because particles of grit are insoluble and are removed with difficulty. Remove any final residue of the cleaning medium with a light oil before filling with new grease. The container with fresh grease must be carefully protected from dirt. Keep the cover on tight. Use a clean, nonmetallic paddle for applying the fresh grease.

Check Air Gap with Four Readings

The correct air gap between the stator and the rotor in a motor is dependent, first, on prop-

Trouble Correction Chart for Alternating-Current Motors—(Continued)

Trouble	Cause	What to Do
Motor Overheats While Running Under Load	Overload	Reduce load.
	Wrong blowers or air shields; may be clogged with dirt, preventing proper ventilation of motor	Good ventilation is manifest when a continuous stream of air leaves the motor. If not, check with manufacturer.
	Motor may have one phase open	Check to make sure that all leads are well connected.
	Grounded coil	Locate and repair.
	Unbalanced terminal voltage	Check for faulty leads, connections, and transformers.
	Shorted stator coil	Repair and then check wattmeter reading.
	Faulty connection	Check to see if resistance is too high.
	High voltage; low voltage	Check terminals of motor with voltmeter.
	Rotor rubs stator bore	If not poor machining, replace worn bearings.
Motor Vibrates after Corrections have been Made	Motor misaligned	Realign.
	Weak foundations	Strengthen base.
	Coupling out of balance	Balance coupling.
	Driven equipment unbalanced	Rebalance driven equipment.
	Defective ball bearing	Replace bearing.
	Bearings not in line	Line up properly.
	Balancing weights shifted	Rebalance rotor.
	Wound rotor coils replaced	Rebalance rotor.
	Polyphase motor running single phase	Check for open circuit.
	Excessive end play	Adjust bearing or add washer.
Unbalanced Line Current on Polyphase Motors During Normal Operation	Unequal terminal volts	Check leads and connections.
	Single-phase operation	Check for open contacts.
	Poor rotor contacts in control wound rotor resistance	Check control devices.
	Brushes not in proper position in wound rotor	See that brushes are properly seated and shunts in good condition.
Scraping Noise	Fan rubbing air shield	Remove interference.
	Fan striking insulation	Clear fan.
	Loose on bedplate	Tighten holding bolts.
Magnetic Noise	Air gap not uniform	Check and correct bracket fits or bearings.
	Loose bearings	Correct or renew.
	Rotor unbalance	Rebalance.

er maintenance of the bearings, and second, on proper alignment of the brackets or pedestals with the frame. Alternating-current motors operate with less air gap than direct-current motors, and are, therefore, more critical. Check the air gap with a feeler gage at the established schedule period. Make these checks at the pulley end, taking four readings on each motor 90 degrees apart. For motors below 10 H.P., a minimum gap of 0.005 inch should be maintained; for those above 10 H.P., the minimum gap should be 0.010 inch.

Synthetic Rubber Belting

Belting made from new GR-S synthetic rubber can be joined to natural rubber belting with a vulcanized splice. This makes it possible to use sections of the synthetic belting to repair existing rubber belting. The B. F. Goodrich Co., Akron, Ohio, states that this company's standard splicing and repair materials can be used for GR-S synthetic belting. Directions are given in a manual on repairing and splicing belting, published by the company.

Grinding to Ten-thousandths Inch on a High-Production Basis

Methods and Equipment Used for High-Production Grinding of Work that is Held to Size within Tenths of a Thousandth of an Inch—First of Three Articles

By RALPH PRICE, Chief Designer
Landis Tool Co., Waynesboro, Pa.

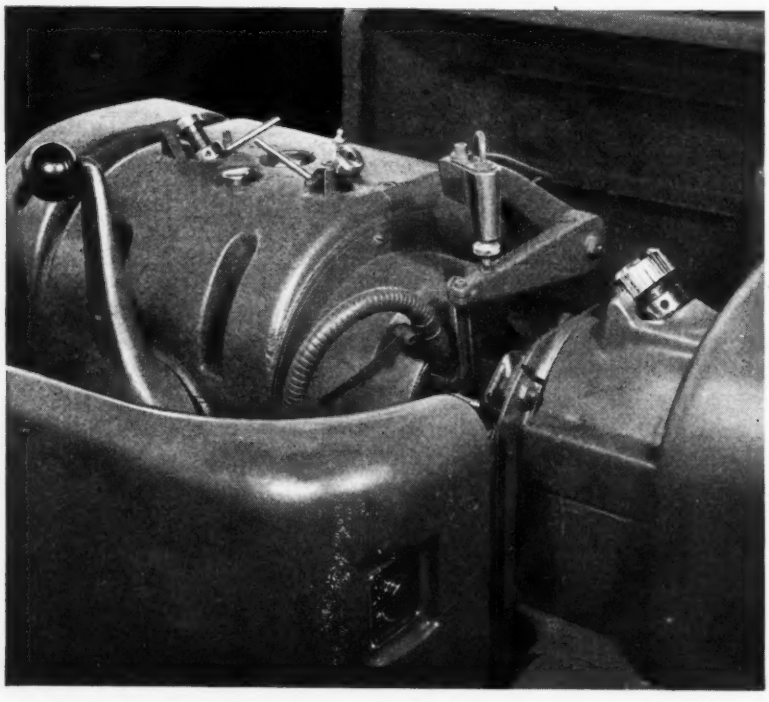
THE extremely close limits and high production demanded for so many wartime and peacetime products make necessary the use of some speedy and fool-proof method of sizing. Obviously, the old method of feeding the wheel by hand and interrupting the cut frequently to check the size with a micrometer is unsatisfactory. In this article, sizing equipment is described which has been developed to solve the problems of precision grinding at high production rates.

Four methods of sizing which are applicable for high-production cylindrical grinding to close limits are as follows:

1. Hand-feeding of the wheel with a visual sizing gage riding the work while grinding is widely employed to increase the production on machines that have not been built with a power feed. This enables the operator to watch the progress of stock removal so that he can operate the feed of the grinding wheel accordingly.

2. Another widely used method, when automatic sizing is not feasible, is to have the wheel fed automatically with a visual sizing gage, and employ manual interruption of the cut when the desired size is reached. Both this method and the one described in the preceding paragraph require the operator to be on the alert and to concentrate on the job throughout the grinding cycle. It is, therefore, obviously out of the question for him to tend more than one machine, as can often be done with automatic sizing. In many cases, he cannot even use the grinding cycle to prepare the next piece.

3. Automatic feed with duplication of machine movements employed to duplicate work sizes is a third method. In this case, the wheel and the work must always be in the same relative posi-



Special Grinder Used for the Internal Grinding of the Inner Raceway of an Outer Ball-bearing Race. The Sizing is Automatically Controlled by the Diameter of the Work

tion when the feed is finished, without any indication or control from the work itself. This is the simplest method of sizing and gives the highest production rates of any, because it requires less care from the operator during the grinding and allows more time for preparing the next piece or loading another machine.

In order to maintain accurate size by this method, however, it is necessary that the feeding elements and the work- and wheel-holding means be maintained in good condition. Not only is it necessary that the feed shall move the wheel-head to the same position each time, but the work must also be in the same position when the grinding operation is finished and the wheel-spindle be held in a definite position by its bearings.

4. An automatic feed with an automatic gage which interrupts the cut and returns the wheel to the back position when the size is reached comprises the fourth method. This arrangement, known as the Landis-Solex sizing device, controls the size from the work itself. Wheel wear, wheel dressing, and variations in the machine itself do not affect the accuracy of sizing, as they do in the positive stop method. Ordinary work can be held to 0.0003 inch at a good production rate, and some special jobs can be held to 0.0005 inch at a high production rate.

The sizing is controlled by the work—that is, by continuously gaging the diameter being ground during the cut. This calls for a very slow feed as the work nears the finished size, to prevent over-travel of the cut. In order to maintain production, two rates of feed are used. A limit contact switch serves to change the feed from the roughing to the finishing rate when the work is within several ten-thousandths inch of the finished size. The slow steady feed required by this gaging method makes it imperative that the ways and all elements of the feed be in good condition.

The device has the advantage that it requires no attention from the operator during the grinding cycle. This often makes it possible for him to operate more than one machine or to attend to other duties, knowing that the feed will stop when the size is reached, with no chance of grinding below the lower limit. The accuracy of the work does not depend upon the operator's alertness or grinding skill, nor upon his ability to read a micrometer with exactitude—a skill that is none too common among new operators.

When the inner raceway of outer ball-bearing races is being ground internally, an unusually large amount of wheel wear takes place, due to the small size of the wheel used. This makes the automatic sizing method particularly suitable as an aid to high production, since the rapidity of wheel wear does not prevent accurate results.

The sizing device finger operates inside the race in such a way that it does not interfere with the wheel. As metal is removed, the finger, which rides in the raceway, causes the gage to actuate an electrical contact. This stops the feed and controls the size of the raceway diameter. At this point, a variation of the usual method comes into play.

Immediately following the stopping of wheel feed, a timing relay permits the wheel to spark out a predetermined fixed period before it automatically breaks contact with the work. This is particularly important when it is wished to grind a radial surface, such as a ball-bearing raceway, so that it will successfully pass the various inspections and tests.

All the methods of sizing described here have their advantages and give excellent service when used with work and on machines to which they are adapted. In all cases where close limits are to be held, it is important that the amount of stock left for finishing be in keeping with the limits desired, and that the variation in the amount of stock to be removed be small. This limitation is not peculiar to any method of sizing, but is more critical on some methods than on others.

Work requiring the removal of a great amount of stock will naturally result in the generation of more heat, especially when a power feed that is continuous is used. This heat causes expansion, which makes it difficult to maintain size. Variations in the amount of stock removed cause variations in expansion, and thus make it impossible to hold the work accurately to size.

It is not possible to lay down hard and fast rules as to the allowable amount of material removal for accurate results, because there are so many variable factors that enter into any precision grinding operation. For example, the nature of the material and the diameter of the work have quite a bearing on the amount of stock that should be removed when a high degree of accuracy is to be uniformly achieved.

The causes of inaccurate grinding and the corrective methods to use will be given in detail in the next article of this series. Among the more important are faulty wheel-base ways or way lubrication, faulty work-carriage ways or way lubrication, an unstable work-carriage, weak work-centers, poorly fitting spindles or centers in either the headstock or footstock, and incorrect handling of the work.

* * *

For some reason, both public and political thinking today seems to assume that the big re-employment burden will be picked up on the production side—that is, by industry. I say that the big re-employment burden must be picked up on the distribution and service side—that is, by business.—*George T. Trundle, Jr., in "Trundle Talks."*

Construction and Application of a Welded Jig

By HAROLD F. WAHL, Hoist Engineer
Willamette Hyster Co., Portland, Ore.

Description of a Boring Jig Constructed by Arc Welding, as Set Forth in a Paper Awarded One of the Prizes in the Recent Contest Conducted by the James F. Lincoln Arc Welding Foundation

THE construction of jigs and fixtures by means of arc welding has been thoroughly recognized by industry as an economical and time-saving practice. In the construction and application of fixtures so made, the importance of stress-relieving should be emphasized at the very beginning. Any welded part, if properly stress-relieved, is as stable as any correctly aged and treated casting; but experience has demonstrated the magnitude of welding and residual stresses, and attention must, therefore, be given to this subject.

A welded precision jig made of 2-inch plate, but not stress-relieved, showed variations in dimensions after having been in use for some time; but a jig made of 3/8-inch plate, properly stress-relieved, showed no variations, although all other conditions and precision requirements were identical.

The proper means of stress-relieving welded parts still requires study. The following treatment for stress-relieving mild steel parts has proved successful in the case of jigs such as described in this article.

1. Heat slowly to 1200 degrees F. Do not heat above this temperature if a coarse-grained structure is to be avoided.
2. Hold at this temperature for one hour, or slightly more, per inch of thickness.
3. Let the furnace cool at its normal cooling rate.
4. If the sections are uniform, withdraw the fixture from the furnace at 800 degrees F. and let it cool in the air. If the sections vary con-

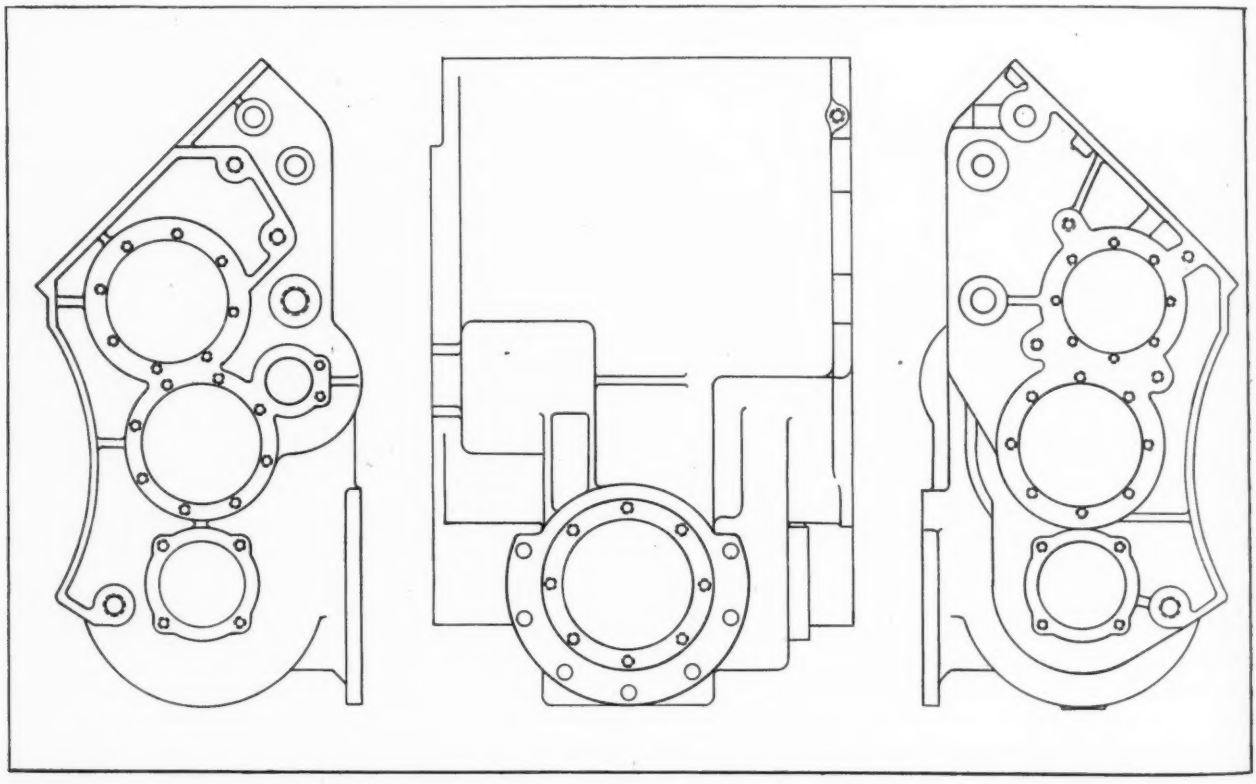


Fig. 1. Transmission Case for a Towing Winch, which is to be Bored

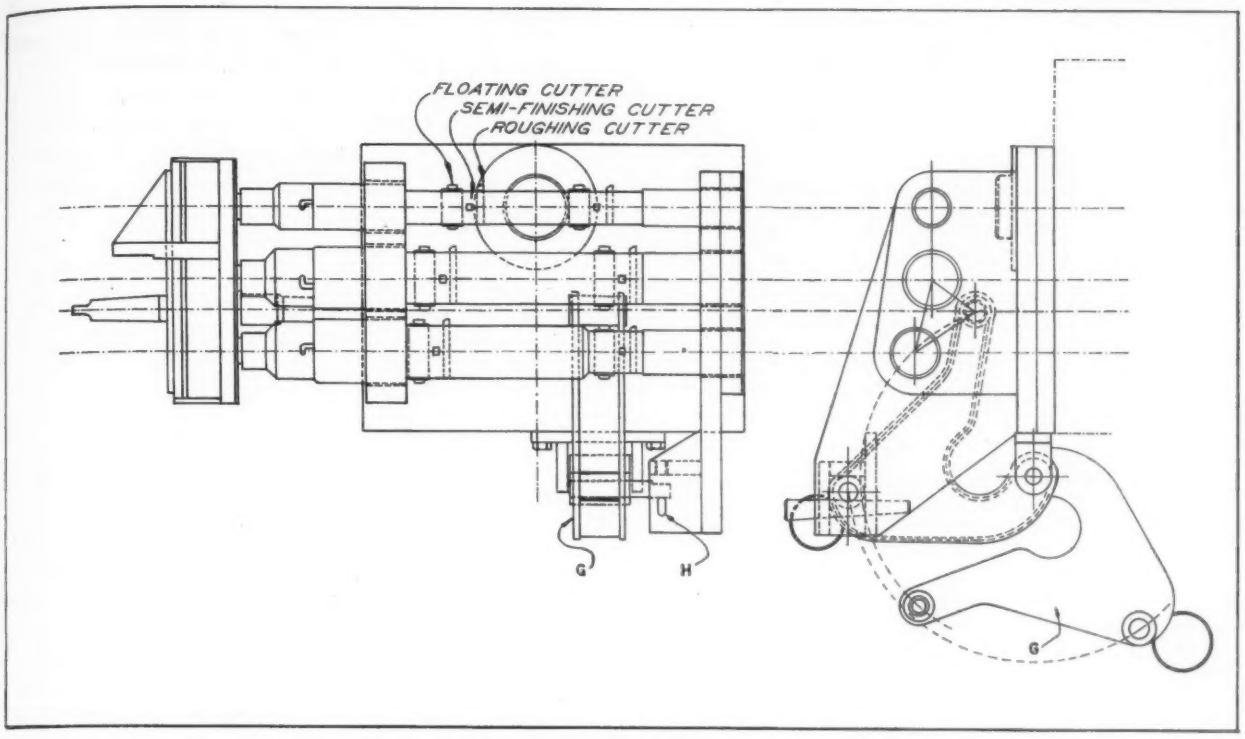


Fig. 2. General Arrangement of the Welded Boring Fixture

siderably, allow the fixture to cool down to 500 degrees F.; then withdraw it and let it cool in the air.

The transmission case for a towing winch is shown in Fig. 1. A fixture is to be designed that will bore all eight holes of the transmission case in one operation. All these bores are gear centers. Anti-friction bearings are mounted in each bore. The precision requirements are similar to those required in automotive practice. The diameter tolerances for the bores are 0.002 inch, and the center distance tolerances are 0.004 inch.

Fig. 2 shows the general arrangement of the fixture. Each of the eight bores is machined by a set of three cutters—one for rough-boring, one for semi-finish boring, and one for finish-boring. As soon as one set of cutters has finished its operation, the following set starts to cut. Four interconnected gear-driven bars carry the cutters.

The heat generated from the cutters is dissipated by a coolant, so that there is no distortion from this source. The fixture clamps are so arranged that they do not impose strains which might cause distortion when the clamps are released.

The production problem in this case is complicated by the fact that relatively small quantities are required. The fact that this welded fixture can be used on more than one type of machine is, therefore, important. The fixture shown has been used on an engine lathe and on several types of horizontal boring mills; hence, there is a broad choice in the selection of the machine on which the work is performed.

The fixture also converts an ordinary lathe or a horizontal boring mill into a multiple-operation machine. A detail of the driving head indicating its simple construction is shown in Fig. 3. The driving bars are of special design. They are driven by a socket-and-pin coupling with a minimum clearance. They can be easily coupled or uncoupled. That part of the bar which is guided in the fixture bushings has pack-hardened sleeves, one being placed at each end of the bar. These sleeves have spirally fluted cleaner grooves which keep the bushings clean and prevent galling. When wear occurs, new sleeves can be substituted without replacing the entire bar. The floating cutter for finish-boring removes from 0.008 to 0.015 inch of stock; the resulting finish is exceptionally smooth.

The fixture supporting the bars is the welded part of the arrangement. It is built of 2-inch plate. Two such plates are placed together to form a 4-inch thickness for carrying the bushings. Lighter construction would be possible if the gear centers were sufficiently far apart and the bores small enough so that the outside diameters of the bushings would not come close together. In this fixture, there is only 1/8 inch of metal between the bushings that come closest together. The bushings are large enough to permit the bar with all the cutters in place to pass through it without interference.

The idler-gear hole is bored with the bar shown in Fig. 4. The arm *G* in Fig. 2 swings

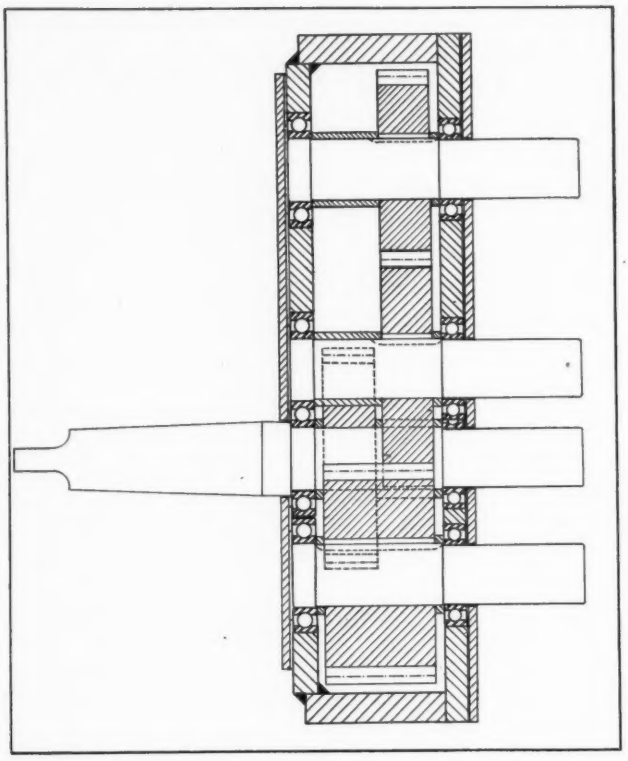


Fig. 3. Construction of Driving Head for Boring-bars

into position after the work has been placed in the fixture. This arm is welded and stress-relieved. It swings on two needle bearings with a clearance of only 0.0005 inch. This arm has not varied in dimensions, so that the required tolerances have easily been maintained. The arm *G* swings upward against a permanent stop which is held in position by a tapered wedge *H*.

The ends of the three boring-bars are hollow. Three supporting rods are pushed into the holes in the ends of the bars when the bars are in the position shown in Fig. 4. These rods rest on an accurately located bracket similar to an ordinary tailstock, except that it supports three bars rather than one. The work-table travels toward the bars. When the bars have entered both bushings in the jig, the supporting rods are removed and the boring operation begins.

The machining of the transmission case originally required eighteen hours. With the boring fixture described, the time has been reduced to 1 1/2 hours. Four of the six cast-iron bushings are replaced after 250 cases have been machined. This is the only item of upkeep, with the exception of the tool bits. It is estimated that the total cost of the welded fixture is approximately $1343, including all overhead and material costs. The cost of a cast-iron fixture, including the making of the pattern, is estimated at $1708. Thus, with the welded fixture, there is a saving of approximately $365, or about 21 per cent.

* * *

Plastic Covers for Machined Precision Parts

What is perhaps the first application in the aircraft industry of protective plastic covers for parts in process in the shop is now in routine use at the East Hartford plant of the Pratt & Whitney Aircraft Division of the United Aircraft Corporation. The first parts for which such protection has been provided are clutch drive-shafts. These are machined with splines on two of their diameters. There are two threaded sections and four surfaces having an unusually high finish (micro-finish).

This shaft is susceptible to damage in process because its largest diameter near the center will act as a wheel, and consequently, the shafts roll against each other, resulting in nicks and scratches. A study of various methods of protection led to the development of a plastic container, which is fitted to the shaft after heat-treating and finish-grinding and guards it as it progresses toward final inspection. Laminated acetate plastic scrap material, rejected by the Army as below specifications for aircraft use, is employed.

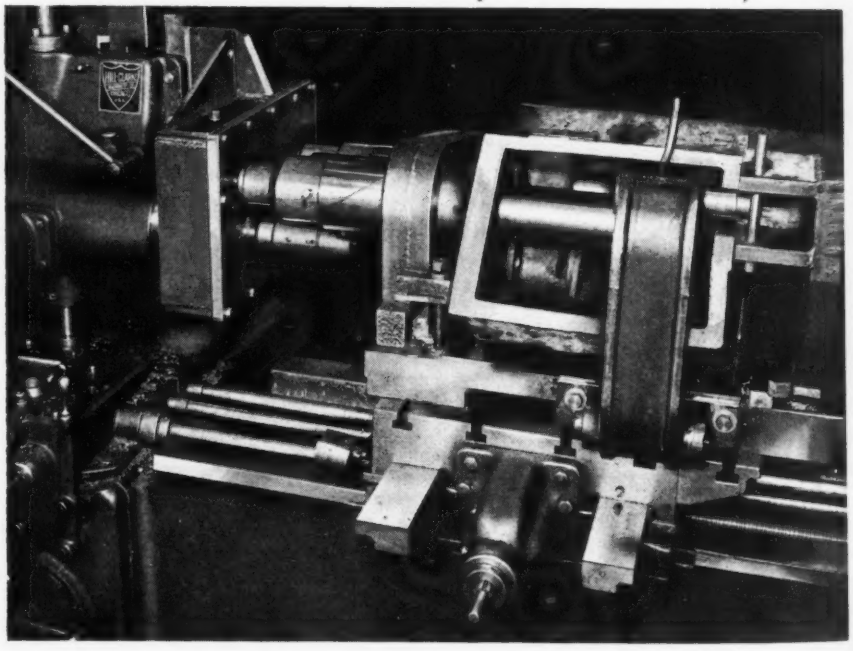


Fig. 4. Arrangement of Machine with Boring-bars in Place

How to Secure Fine Surfaces by Grinding

By the Late H. J. WILLS
and H. J. INGRAM, Engineer
The Carborundum Co., Niagara Falls, N. Y.

Eleventh of a Series of Articles Describing the Factors that Govern Fine Surface Quality and the Means by which This Quality Can be Obtained—The Present Article Deals with Machine Lapping Operations

TODAY, there is very little strictly hand-lapping in which the workman holds the work in his hand and rubs it over a stationary lap. While this process gave close accuracy and fine surface qualities, it was slow, expensive, and required long training and experience.

The striving of automobile builders to produce better cars which would not require running-in periods necessitated that many parts be given a smoothness of surface and accuracy which closely approached that produced by hand-lapping, but could be obtained much more rapidly, so that the operation would be in step with the other operations of mass production shops. This was not a particularly difficult problem, for the requirements of a lapping machine are merely that it give the work or lap a motion that will "break up the pattern" at low pressures and high speeds. The first machines utilized the hand-lapping practice of using abrasive grain suspended in a vehicle, and a lap made of a soft or porous material, such as babbitt or cast iron.

One of the earlier mechanical lapping machines was a homemade type used for lapping the wrist-pins of an automobile. It was fashioned out of a drill press, with a stationary cast-iron lap fastened to the work-table, an upper lap driven by the spindle, and between the two laps a work-holder which rotated and oscillated. This could be used for flat or cylindrical pieces, the cylindrical ones being placed tangentially between the laps. The speed of the work-holder was about half the speed of the lap. This type of machine is still used. Several variations of the metal-lap mechanical lapping machines can be constructed to suit individual needs if the amount of work does not warrant investment in a standard machine.

Commercial Lapping Machines

In the commercial machines designed for comparatively small flat or cylindrical parts, the metal laps are serrated or grooved to catch particles of abrasive and material and to help reduce surface irregularities. It is essential to keep both the upper and lower laps flat, parallel, and smooth. This is done by lapping them against each other frequently and by reversing them, putting the upper one at the bottom and vice versa. When a high degree of precision is required, it is advisable to stop the machine after a few minutes operation and transpose the parts in the work-holding fixture. By doing this repeatedly, any errors in dimensions are rectified. Incidentally, this method tends to keep the lap faces worn equally at all points.

In quite recent years, machines have been developed which, while they make use of the fundamental principles of lapping—namely, low pressure, high speed, and a complicated path of the abrasive over the work—substitute flat, bonded abrasive wheels or disks for the abrasive-charged metal laps. Some people object to this being called "lapping," the contention being that if the work is not done with a metal lap and loose abrasive, it is not lapping but grinding. This seems to be needless hair-splitting over unessential nomenclature. The basic principles of the operation are the same, and the dimensional accuracy and surface qualities secured are comparable.

Lapping Machines Using Abrasive Wheels

In lapping machines using abrasive wheels, both of the abrasive wheels revolve, but in opposite directions and at slightly different speeds. Between the two wheels is the work-holder which revolves comparatively slowly, usually at about half the difference in speed of the two wheels. For example, if the top wheel rotates clockwise at about 340 R.P.M. and the bottom one counter-clockwise at about 240 R.P.M., the work-holder should rotate at about 50 R.P.M.

For flat work, the work-holder is usually merely a plate containing holes to hold the work. When great accuracy is desired, the path of the abrasive may be still further complicated by means of a more complex work-holder. One work-holder consists of a planetary adapter

with holes for the work, which itself revolves around a central disk which also revolves and oscillates. These machines can produce flat work lapped to within 0.000025 inch for dimension, and a few millionths for both straightness and parallelism, on a commercial basis. Such work will have a surface roughness of less than 2 micro-inches r.m.s.

In lapping round work on abrasive-wheel machines, the parts are held in a work-holder which takes its motion from the rolling motion of the work between the laps. A suitable eccentric motion is given to the work-holder by a mechanism in the machine.

Present-day machines are adapted only for fairly small work. The maximum size of cylinders that can be accommodated when several are lapped at once is about 4 inches in diameter by 7 1/2 inches long. Flat sides can be lapped on these machines on disks up to about 3 inches thick by 8 inches in diameter, and on squares with 7-inch sides. The work turned out by abrasive-wheel machines does not usually have quite such fine surfaces as those produced by machines using cast-iron laps, but the production rate is much higher.

Centerless Grinding Principle Applied to Lapping

High lapping production can be secured on certain types of parts on a machine that operates on the centerless grinding principle. This machine is, of course, applicable only to cylindrical parts, and mostly to those that have no interfering shoulders. However, parts such as camshafts which cannot be passed transversely through the machine can be lapped by the centerless method on the main bearings by lowering the shafts between the wheels by means of a specially designed loading device.

Dimensional tolerances of 0.00005 inch for diameter and 0.000025 inch for straightness are readily secured on centerless lapping machines. A surface quality of about 2 micro-inches r.m.s. is obtainable. Surfaces of various degrees of luster can be obtained by changing the grade of the lapping wheel or the wheel or work speeds. No work-holders are used for straight cylindrical parts, and production is practically continuous, since the work-pieces pass between the wheels nearly end to end. Parts to be lapped should come to the centerless machine with a ground surface of good commercial finish, accurate to within 0.00025 inch, and as round as the finished work must be.

If a surface of 4 to 6 micro-inches r.m.s. is all that is needed, the operation is done with a wheel of 180 grit. This is called a "lap-grind" operation. If a surface of 2 to 3 micro-inches r.m.s. is required, the lap-grind operation is followed by one with a 500-grit wheel. A somewhat better finish can be secured by an additional pass, removing practically no stock.

The regulating wheel is of 320 grit, resinoid bond. The lap-grind wheel is vitrified bond, and the lapping wheel resinoid. The machines have but a single speed for the lapping wheel, but may be obtained to drive the wheel at about 550, 720, or 840 surface feet per minute. The lower speeds produce better finishes. The wheels are all 14 inches in diameter by 22 inches wide.

Special-Purpose Lapping Machines

Among the special-purpose lapping machines are those for lapping the main and crankpin bearings of crankshafts simultaneously and for doing the same for all bearings and cams on camshafts. These machines can be obtained either for hand or semi-automatic operation. They use coated paper or cloth, which fits itself to complicated contours, so that all surfaces and fillets are finished in one operation.

Because crankshafts are soft, it is not easy to secure the finer surface qualities on them; but with these machines it is possible to lap them to 2.5 to 4 micro-inches r.m.s., provided the previous operation has produced a surface as good as 20 micro-inches r.m.s. The time required is from fifty to sixty seconds. Camshafts can be lapped to from 2.5 to 4 micro-inches r.m.s. in about thirty seconds, due to the greater hardness of the camshaft material. An even pressure on the cams is insured by a master cam device. The pattern on the surfaces of both crankshafts and camshafts is broken up by means of a reciprocating device.

Economical lapping with any type of machine depends to a considerable extent upon the condition of the surface when it comes to the machine. If the surface is "too good," the probability is that the preceding grinding operation has been too slow and costly. On the other hand, if the surface is much above twenty times the profilometer reading of the desired lapped surface, the lapping will be unduly slow and expensive. About ten times the lapped surface finish in micro-inches represents the best practice.

* * *

A process has been developed by a Westinghouse chemist for preparing zinc surfaces to take a protective coating of paint. This process is now being applied on a commercial scale for the protection of hundreds of zinc-coated machine parts for both war and peace. It consists in giving the objects a titanium predip and then a disodium phosphate coating. The titanium predip is said to increase the life of thin zinc coatings fifty times.

Measuring to Hundred-Thousandths with Vernier Gage-Blocks

Precision measurements in increments as fine as 0.00001 inch can be made with the new DoAll vernier gage-blocks shown in Figs. 1 and 2. These vernier blocks, made by Continental Machines, Inc., 1312 S. Washington Ave., Minneapolis 4, Minn., have been developed to extend the range of combinations of sizes that can be made up with any set of gage-blocks.

The increased versatility of a set of gage-blocks resulting from their use in combination with the new vernier gage serves to reduce the cost of producing special gages for dimensions that are required to be held to extremely close limits. Gage-blocks in combination with the vernier gage can be quickly set up for use as practically any type of snap gage, height gage, and depth gage for measuring to 0.00001 inch. When used in combination with gage-blocks, a precision sine bar can be set to the required angle within an accuracy of two seconds.

These DoAll vernier gages, although adapted for precision measuring, are simple in construction. The gage consists of two blocks having a precision taper on their mating faces. When the taper faces of the two blocks are wrung together with their taper index marks coinciding, the blocks form a measuring gage-block whose height is 0.700 inch.

One block is graduated into ten equal parts between the index graduations. By sliding this block to the right, the height of the vernier gage is increased 0.00001, or ten millionths of an inch, for each graduation. By sliding the block to the left, the height of the vernier gage is decreased 0.00001 inch for each graduation. The vernier gage, therefore, has a total range of one ten-thousandth inch plus or minus, which enables dimensions to be measured in increments of 0.00001 inch above or below any dimension covered by the use of a standard set of precision gage-blocks.

* * *

Reamers and Drills Tipped with Carbide

Reamers tipped with carbide cutting edges are now being used to an ever increasing extent in industry. The Springfield Armory, Springfield, Mass., has made considerable use of such tools. The reamers used to remove scale and some stock in operations performed on rifles in the past produced only from 20 to 40 pieces before they were worn under size. Reamers tipped with Carboloy have produced from 100 to 700 pieces each. The life of gun drills for gas piston tubes in automatic rifles has been increased tenfold by tipping with Carboloy.

* * *

Pure Water for Electroplating

For many industrial purposes, distilled water has been considered necessary. A new process has been developed for the purification of water that will replace distilled water at a fraction of the cost. This process is said to produce "deionized" water suitable for any industrial purposes. The process has been developed by the Illinois Water Treatment Co.; Hanson-Van Winkle-Munning Co., Matawan, N. J., is the sales representative for this process in the metal-finishing and electroplating industries where pure water is a necessity.

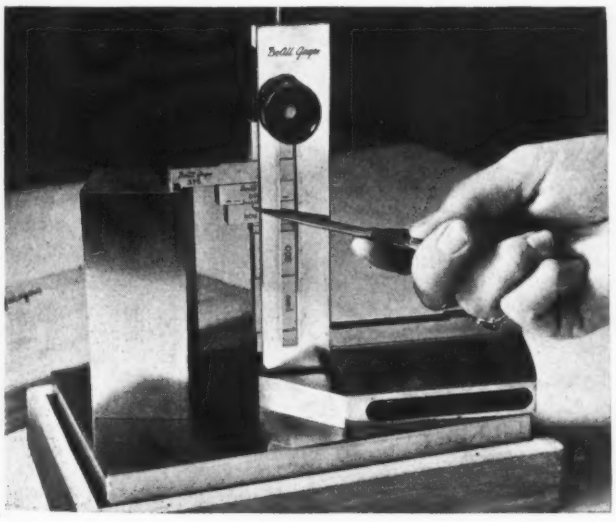


Fig. 1. Height Gage for Measuring to 0.00001 Inch, which Comprises Precision Gage-blocks, Holder, Master Flats, and DoAll Vernier Gage

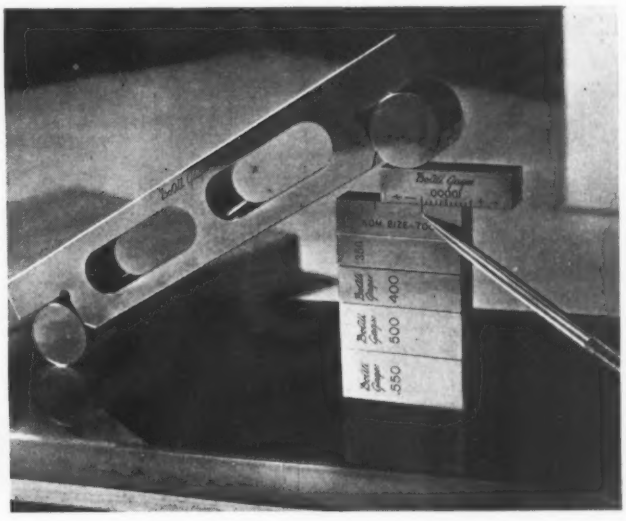


Fig. 2. DoAll Vernier Gage Used with Standard Gage-blocks, Master Flat, and Sine Bar, for Measuring Accuracy of Angles to Two Seconds

Engineering News

Production Line X-Ray Equipment Now Available

For several years, industry has found X-ray inspection invaluable, but the cost of the apparatus and film restricted the use of this inspection method to special or exceptionally important work. Recently, the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., has developed a radiograph that can be used right in the production line and that provides photographic records for a fraction of the former cost. This equipment uses a high-speed camera which makes 2-inch film negatives instead of the larger sizes generally used. The photograph is made of an image cast upon a fluorescent screen 1 foot square. About 300 exposures can be made on a single 50-foot continuous roll of film. In order to adapt the unit to production lines without endangering the workers, it is so designed that no special lead-lined equipment is required.

Effect of Small Amounts of Hydrogen in Steel

According to a paper read before the American Institute of Mining and Metallurgical Engineers by Dr. Herbert H. Uhlig, metallurgist of the General Electric Research Laboratory, very small amounts of hydrogen in steel—as small as 0.0005 per cent by weight—can make steel brittle, and any hydrogen content must be avoided in steel when toughness and ductility are the essential qualities. The effect of hydrogen is accentuated in most steels containing manganese. The subject is one on which research is still being carried on.

Electro-Tinning Applied to Strip Steel for Food Containers

The Halogen tin process, developed by the Electroplating Division of E. I. du Pont de Nemours & Co., is one of the recent contributions to the efforts being made to conserve important metals. It is estimated that, by the use of this process, yearly savings of tin totaling 1,200,000 pounds will be accomplished. In addition to the saving of tin, the process speeds up the production of tin plate.

One of the largest installations of this process is now operating at the Weirton Steel Corporation, Weirton, W. Va. The advantages claimed over the conventional hot-dip tinning of strip steel are that very thin coats can be deposited by the electroplating method and these coats are of more nearly uniform thickness than formerly. Furthermore, the process lends itself to accurate control, and coats can be applied in different thicknesses according to the use for which the strip steel is intended.

Glass Replaces Sapphires in Electrical Instruments

Tiny glass jewels have replaced sapphires as bearings in certain types of electrical instruments produced at the Westinghouse Meter Division at Newark, N. J. The war has made it difficult to obtain sapphires from Switzerland. Now it appears that these American-made glass jewels will be retained after the war for use in many electrical devices. It has been ascertained that, in certain instruments, glass jewels produce less over-all friction than sapphires.

Spectroscope Used to Classify Steels for Gear Making

Several years ago, Westinghouse engineers developed a method of producing gears from ordinary carbon steel through the use of special heat-treatment. It would appear to be a distinct advantage to use this type of steel now that war has created so many shortages. However, the appeal for scrap has brought steel of every kind to the steel mills which, having neither time nor facilities for sorting the scrap, dump it into furnaces as it comes to them. The result is that some shipments of ordinary steel contain more nickel than the so-called nickel-steel alloys.

In order to sort out and classify these steels for making gears, every new batch of steel received at the Westinghouse plant is subjected to a spectroscopic analysis. Normally a laboratory instrument, the spectroscope is rapidly becoming a factory tool. It identifies the spectral lines of every element in an unknown substance, and permits classification of the steels for proper heat-treatment. In this manner, each batch of metal can be adapted to meet the requirements of a specific application.

The Prospects for Individual Initiative in Post-War Years

By HERB RAWDON
Consulting Engineer, Wichita, Kan.

THE articles in January MACHINERY in the section headed "Industry Plans for the Future" interested me a great deal. It is obvious that our people as a whole can have only the things that they, themselves, produce and, therefore, the standard of living can only be improved as the quantity of goods that have utility to the individual can be increased. This point is fundamental, and has been well emphasized in numerous editorials in MACHINERY. However, there are many people today of national repute who insist that the type of production sponsored by the Government (like war equipment production) also produces prosperity. This is very disconcerting.

Obviously, free enterprise is the only type of industry that can distribute most widely goods having utility to the average man and woman, and no other system will do it. The efforts of the Government to *make work* have little value to the national prosperity as a whole. "Made work" is planned as a sort of donation by the public, and must therefore be kept at a minimum if the people at large are to have the kind of work that will be directly useful to them.

We often hear it said that after the war the Government will retrench and relinquish its extended controls over business and let industry use its individual initiative, the same as in the past. While this is a most desirable prospect, it is, under present circumstances, highly improbable. There is no indication that the present leaders in our Government have either the desire or the intention of giving up the controls and restrictions which they have established.

If industrial leaders continue to take such a weak stand toward the increase of Government control as they have in the past, I feel assured that we are headed for more control rather than less. I have been associated for a great many years with one of the most highly regulated of our industries, and I know how things generally work out. Something besides talk is necessary. Industrial leaders must combine and take a firm stand, in order to reduce Government control and interference in industry, because the men now occupying the high places in Government have not the slightest inclination to reduce this Government control.

You cannot expect that an administration, which has become entrenched in office by making everything in our daily life an emergency, and which has continually sought to obtain more and more control through labeling everything an emergency, would look favorably upon a reduction of this bureaucratic control when the war is over. The war has created such an unbalanced and artificial condition in finance, industry, and employment that severe reverses from these maladjustments are certain; this will give our bureaucratic Government an opportunity to talk loudly about a new emergency and the necessity for additional controls.

In my personal opinion, we will have to face a situation after the war with more and more violent disagreement on policies than now exists. There is little excuse for passing lightly over the maladjustment of the present situation and refusing to face the fact that the Government will find in the post-war situation a still greater apparent emergency than that of the present.

It is of no use to think about post-war activities from an ideal and unrealistic point of view; we might just as well face the conditions as they are likely to be unless the American people decide to make a very radical change in its leadership. I have no ready solution to offer for any of the difficulties that we are certain to face, but I know that we must get down to earth and reason matters out in a common-sense manner. The longer we continue to believe that emergency conditions exist in our everyday life, the more difficult will be the ultimate readjustment to sensible national policies.

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Music in Industry

The first film to portray the uses and results of musical programs in industrial plants has been produced by the Radio Corporation of America. This motion picture emphasizes the important part carefully planned musical programs have come to play in war plants throughout the country. The picture was made at the Botany Worsted Mills, Passaic, N. J., where an RCA plant broadcasting system is in operation.

The film illustrates the many uses of an internal broadcasting system in an industrial plant, not only for broadcasting recorded music, but also for the instantaneous relaying of messages, handling emergencies, making announcements, paging, etc.

The running time of the film is eighteen minutes; 16-millimeter prints are available to industrial organizations, engineering societies, and trade associations through the Sound Picture Division, RCA Victor, Camden, N. J.

Ingenious Mechanical Movements

Mechanisms Selected by Experienced Machine Designers as Typical Examples Applicable in the Construction of Automatic Machines and Other Devices

Dial Transfer Mechanism for Chain Making Machine

By CHARLES F. SMITH

The dial transfer mechanism shown in the accompanying illustrations is of rather unusual design. It was developed by the writer for use in a chain making machine that he designed. The function of the mechanism consists of picking up a piece of work at *M*, Fig. 1, and transferring it to the position indicated at *N*. Since the limited space available made it impossible to employ an ordinary cam arrangement for transferring the work, it was necessary to develop the special mechanism here shown.

The problem of transferring the work from *M* to *N*, which was too long a distance to permit using a single cam movement, was solved by employing an indexing dial transfer movement, effected by a Geneva motion in combination with a comparatively short reciprocating motion obtained by a barrel cam.

Referring to Fig. 1, the transfer of a piece of work from *M* to *N* is accomplished by a combination of two indexing movements of the Geneva actuated dial *C* which carries the piece from *M* to *O* and a traversing movement of the dial *C* through a distance *T* by the action of the barrel cam *J*, Fig. 2. The latter movement carries the piece from *O* to *N*.

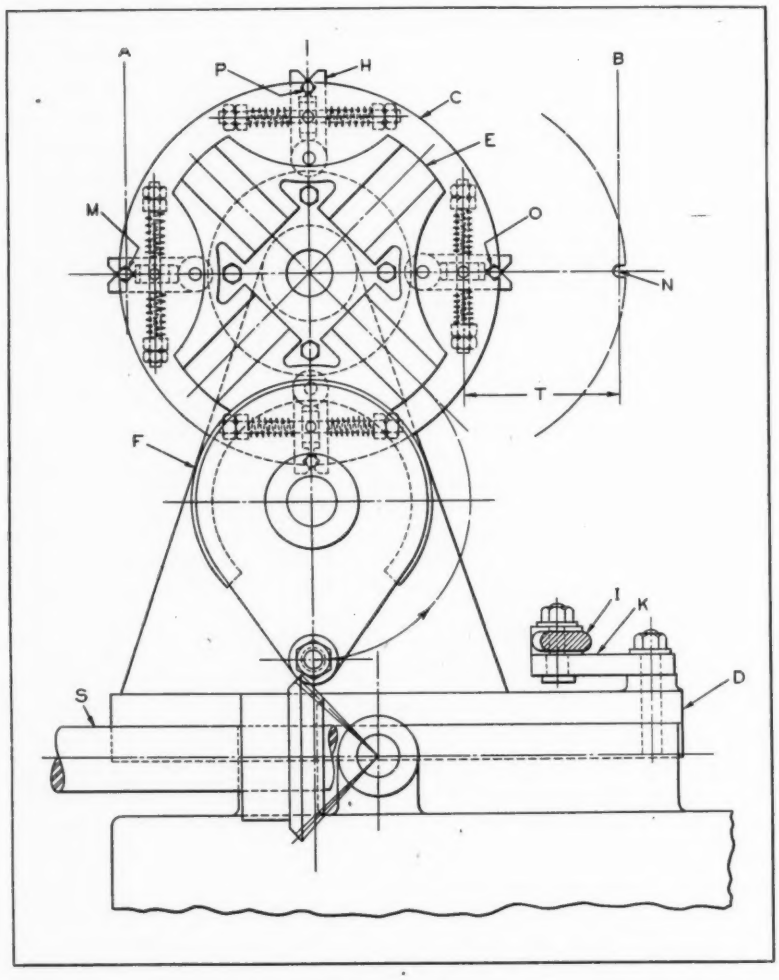


Fig. 1. End View of Dial Transfer Mechanism Used in Chain Making Machine

Assuming that dial *C* is indexed in a clockwise direction, the piece picked up at *M* will be indexed to position *P*, where it remains idle while the preceding piece at *O* is carried to *N*. Then, on the second indexing movement of the dial, it is carried to position *O*, from which it is transferred by the movement of dial *C* through distance *T* to position *N* during the idle period of the dial.

The jaws *H* are spring-operated. The mechanism is driven by shaft *S* on which the barrel cam *J* is mounted. The entire Geneva mechanism is mounted on a slide *D*, which is given the required intermittent reciprocating motion by barrel cam *J* through lever *I* and connecting link *K*.

The driver *F* of the Geneva mechanism is driven from shaft *S* through miter gears *R*, spur gears *U*, and universal-joint shaft *G*, which permits the slide *D* to move on the base without interfering with the transmission of rotary motion to driver *F*.

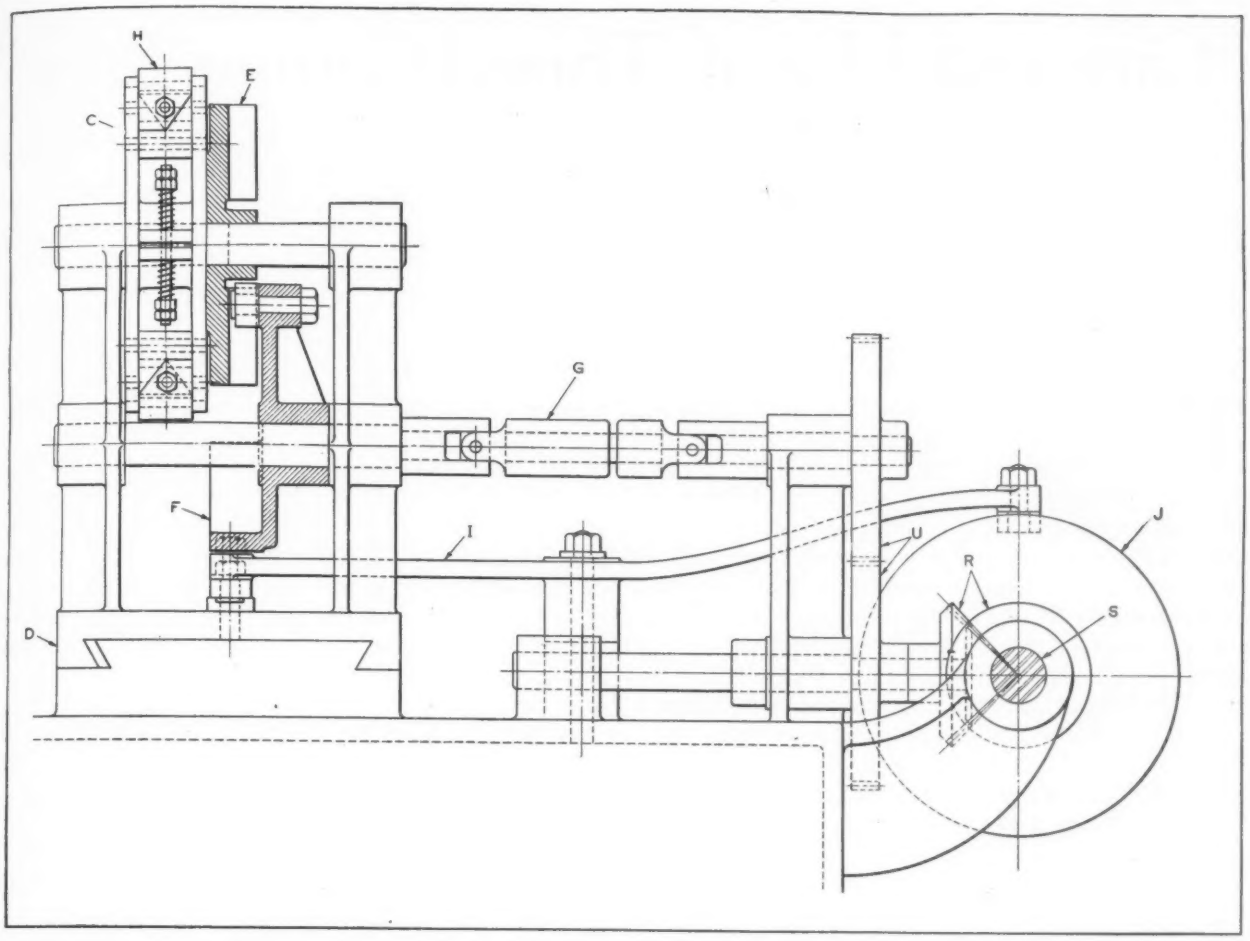


Fig. 2. Front Elevation View of Transfer Mechanism of Chain Making Machine

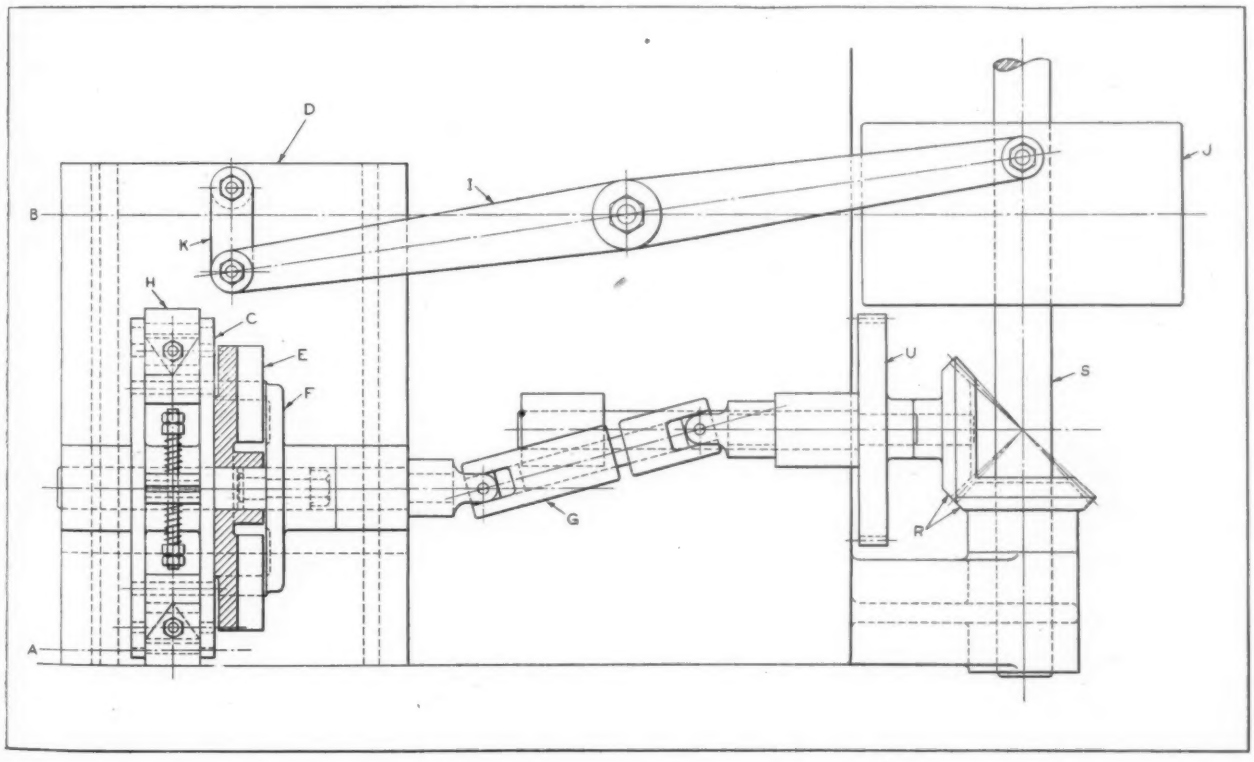


Fig. 3. Plan View of Mechanism Shown in Figs. 1 and 2

Care and Use of Thread-Cutting Dies

Recommended Practice in Maintenance and Application of Thread-Cutting Dies with Tangential Type Chasers

By M. B. HENNEBERGER
Landis Machine Co., Waynesboro, Pa.

THE efficient operation of die-heads, thread-cutting machines, and collapsible taps to obtain good quality threads at high production rates is of the greatest importance in all war equipment manufacture. It may appear that this involves many intricate mechanical problems. Poor thread quality and low production can easily be overcome, however, by making a common-sense analysis of the conditions under which the trouble occurs. There are several basic rules which, if adhered to closely, will assure good thread quality and high operating efficiency. These rules include good chaser grinding practice, the use of chasers having correctly formed throats, and the employment of suitable cutting oil.

Naturally, good grinding practice should be considered first, since the entire thread-cutting operation depends upon the chaser or cutting tool that produces the thread. The blame for poor thread quality and the failure of thread-cutting equipment is placed upon the chaser 95 per cent of the time. However, in many instances, the chaser is not at fault.

There has been developed a series of basic rake angles to which tangential type chasers should be ground to assure a free cutting action. These angles, given in Table 1, are based upon the average machinability of the various metals listed. A little experimentation will readily determine if a slightly larger or smaller angle is better suited to a specific job.

In the grinding of Landis tangential type chasers, there are but two angles to be considered—the lead angle and the rake angle. The lead angle is the one formed by the end of the chaser with the center line of the work being threaded. The rake angle is the clearance angle to which the chaser should be ground to obtain efficient cutting action.

Grinding Chasers for Cutting Straight Threads without a Lead-Screw

The recommended practice for grinding tangential chasers for cutting straight threads without the aid of a lead-screw or positive means of feeding the threading die is illustrated in Fig. 1. The correct lead angle for all American Standard Coarse Series, Whitworth, and S.I. standard threads is 90 degrees. The lead angle for American Standard Fine Series, S A E, and B.S.F. threads is 90 degrees for chasers of 11 pitch and coarser, and 92 degrees for chasers of 12 pitch and finer.

The special hooked grind form or method of sharpening chasers shown in Fig. 3 is recommended for cutting straight threads of standard diameter and pitch without the use of a lead-screw or positive feed for advancing the thread-

Table 1. Rake Angles for Landis Chasers

Material		Rake Angle	Material		Rake Angle
Brass	Cast	5 Deg. Negative to Zero	Nickel Steel	Annealed	25 Deg. Positive
	Drawn	10 to 22 Deg. Positive		Heat-treated	18 to 22 Deg. Positive
Iron	Cast	15 Deg. Positive	Monel Metal		25 Deg. Positive
	Wrought	18 Deg. Positive	Manganese Bronze		Zero to 10 Deg. Positive
	Malleable	18 Deg. Positive	Copper		28 Deg. Positive
Aluminum	Cast	10 Deg. Positive	Bakelite		Zero
	Drawn	25 Deg. Positive	Duralumin		25 Deg. Positive
Bronze		10 Deg. Positive	Stainless Steel		25 Deg. Positive
Basic Steel		22 Deg. Positive	Fiber		35 Deg. Negative
Seamless-steel Tubing		25 Deg. Positive	Naval Bronze		Zero to 10 Deg. Positive
			Everdur		22 Deg. Positive

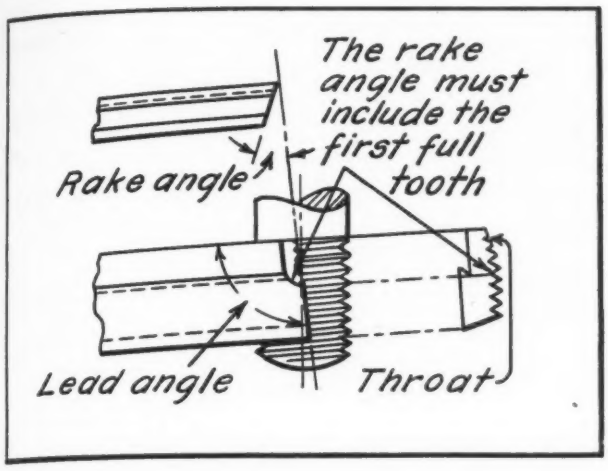


Fig. 1. Diagram of Tangential Chaser Ground for Cutting Straight Threads without a Lead-screw

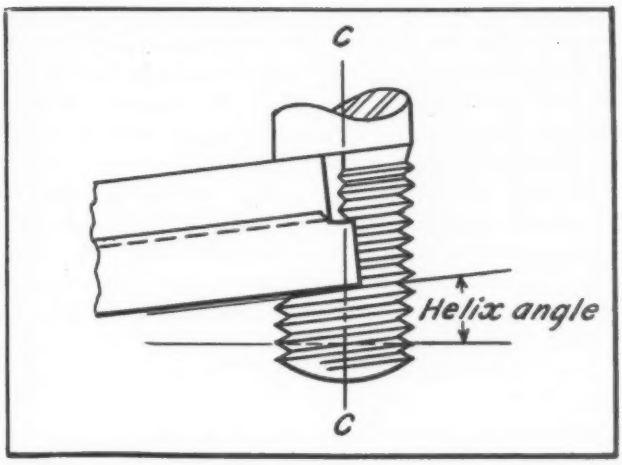


Fig. 2. Chaser Ground as in Fig. 4 has Cutting Edges Located on Cutting Center Line of Work

ing die. This method of grinding is frequently recommended for use in threading heat-treated materials and special alloy steel.

The special hooked form of grind shown in Fig. 4 is used for cutting a straight thread of special diameter and pitch without the use of a lead-screw or positive feed. This special method of grinding chasers is recommended for use in cutting special or standard thread forms on work of non-standard diameters when the material being threaded is a heat-treated alloy steel and the thread is required to be accurate with respect to the lead angle for the specified diameter and pitch. Each of these special methods of grinding is designed to locate the cutting edges of the chasers on the cutting center line of the work, as shown in Fig. 2.

Grinding Chasers for Cutting Straight Threads with a Lead-Screw

The recommended method of grinding chasers for cutting straight threads when a lead-screw or positive feeding action is used is shown in Fig. 5. With this type of grind, all lead-controlling features of the chaser itself are removed, so that the lead-screw or positive feed controls the cutting action of the chaser.

Probably even more important than the rake angle or lead angle is the form of the chaser

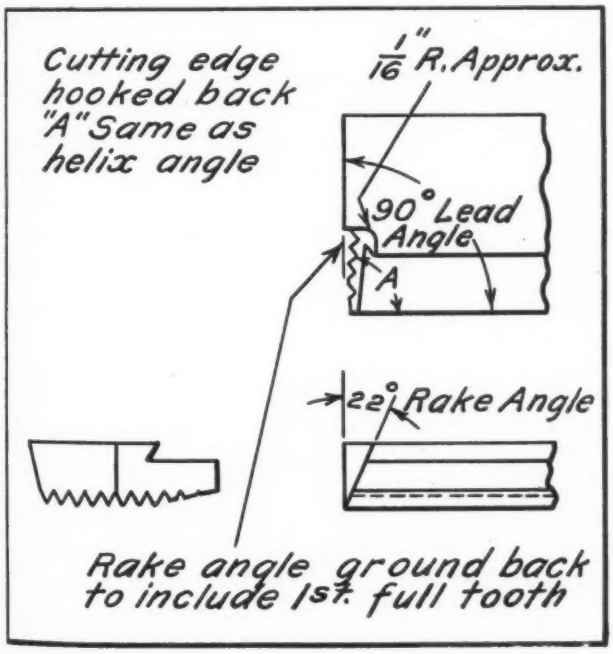


Fig. 3. Chaser with Special Hooked Form of Grind for Cutting Straight Threads of Standard Pitch and Diameter without a Lead-screw

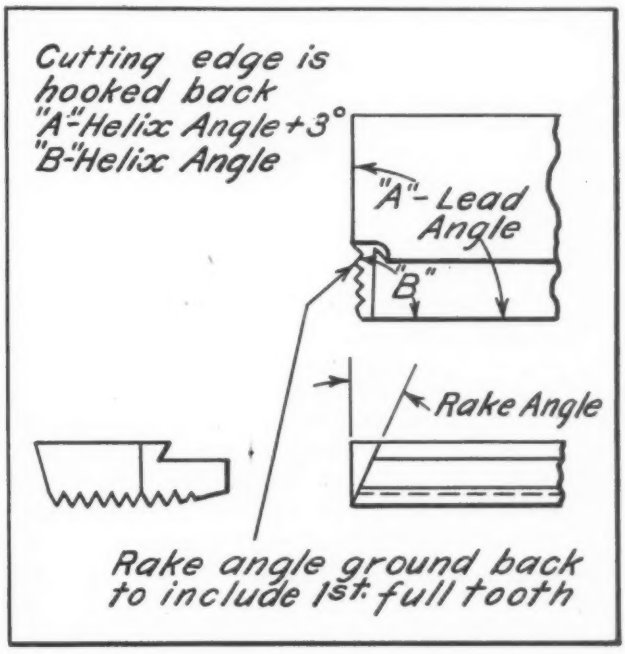


Fig. 4. Chaser with Hooked Form of Grind Set at Helix Angle, as in Fig. 2, for Cutting Standard or Special Threads on Work of Non-standard Diameter

throat. Even though the rake angle of the tangential type chaser is variable, it has been found that the throat angle directly controls the quality of the thread produced. The length of the chaser throat controls the distribution of the cut in pre-forming the thread.

A long chaser throat forms the thread more gradually than a short throat, and should be employed whenever possible. If, however, the threads are close to a shoulder, it is absolutely necessary to employ a short throat chaser. Short throat chasers, as a rule, will produce not only fewer threads per grind, but the quality of the thread will not compare with that of a thread produced by chasers having long throats. Furthermore, a short throat chaser cannot be operated at the high cutting speed that can be employed when long throat chasers are used.

Fig. 6 indicates the various throat angles which are provided on Landis tangential type chasers. Here, again, the recommended uses for the various throats are offered merely as a guide; prevailing conditions may be such as to prevent their use.

Coolants Recommended for Thread Cutting

Many users of thread-cutting equipment are inclined to discount the value of a cutting coolant that has been developed scientifically both for cooling and lubricating qualities. However, this seemingly unimportant detail has often been responsible for the difference between rejected threads and threads of the finest quality.

In Table 2 are listed the cutting lubricants recommended for the most common metals and materials threaded by means of dies. The correct

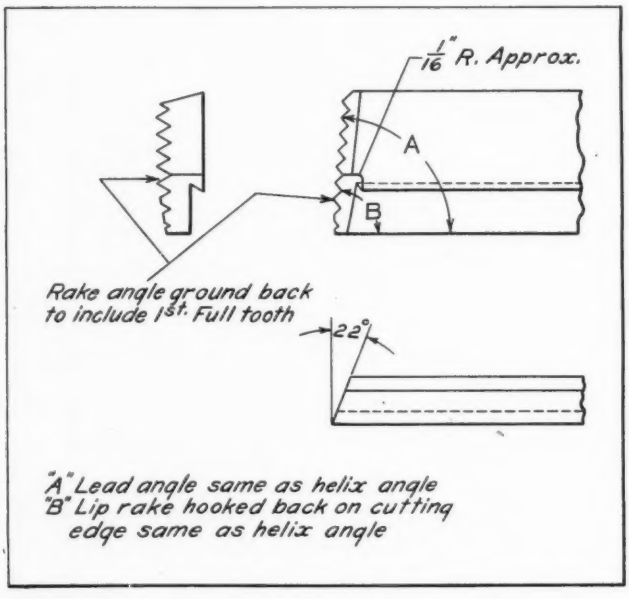


Fig. 6. Diagram Showing Throat Angles of Landis Tangential Type Chasers Recommended for Cutting Various Types of Threads

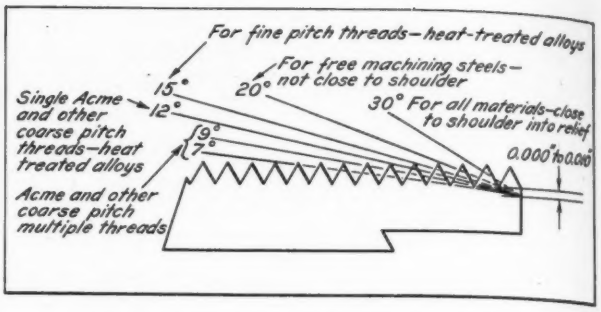


Fig. 5. Chaser Ground for Cutting Straight Threads when a Lead-screw or Positive Feeding Action is Employed

cutting lubricant or coolant is, of course, best determined by experimentation with the material and machine on which the threading operation is carried out. As will be noted, compounds are not recommended for steels, although they are frequently used. The saving in price effected by using a compound instead of a good cutting coolant may be offset by loss in production and higher tool upkeep.

In addition to poor grinding practice and incorrect lubricant, the following reasons for mechanical failure of chasers should be eliminated in an effort to obtain maximum operating efficiency. The forcing of badly sheared stock into the dies, which causes chaser breakage; misalignment between the die-head and the work, which results in taper and side-shaved threads; work gripped loosely, so that it can slip under the rotating drive, causing chipping on the cutting edge of the chaser; chasers set too far over the center, which results in rough threads and rapid chaser wear; lack of uniformity in setting of chasers, resulting in unequal distribution of the cutting action, damaged chaser clamps and chaser-holders, which throws the cutting load on one chaser; and cooling chasers in water when overheated in grinding, which causes grinding cracks and chaser breakage.

The failure of die-heads to function properly not only results in threads of poor quality, but frequently causes excess chaser breakage. The work and the die-head should be checked constantly for misalignment which will cause side-shaved threads, drunken lead, and chaser chipping on the cutting edge. In mounting a die-head in the machine, a dial indicator should be employed to test the alignment of its bore with the machine spindle.

Die-heads applied to automatic machines frequently fail to give the desired service when a cam and starting spring are employed to start the die-head on the work. A cam that does not provide the correct lead corresponding to the revolutions per minute of the work will cause the sides of the thread to be shaved and result in an error in the lead. Excessive starting tension

will cause the front side or angle of the thread to be shaved, whereas too weak starting tension will cause the back angle or side of the thread to be shaved.

Thread-cutting machines are usually of simple design, and consequently, seldom subject to mechanical failure. However, to assure maximum operating efficiency with equipment of this type, it is essential that certain mechanical details be checked regularly. A bolt-threading machine should, of course, be oiled frequently. All bearings and flat surfaces should be lubricated daily; this is especially important until the machine is well worn in. Care should be taken to see that the machine is properly leveled, so that the gears that are designed to run in a bath of oil will be submerged to the proper level.

A frequent form of trouble on bolt-threading machines, especially those of the lead-screw type, is the maintaining of the lead within specified tolerances. Continual use will naturally wear the lead-screw and lead-screw nut. The lead-screw nuts are usually made from bronze, and should be replaced when they become worn to the extent that end play cannot be eliminated by adjustment.

It should be kept in mind that it is not possible to replace lead-screw nuts repeatedly without replacing the lead-screw; and when a lead-screw is replaced, new lead-screw nuts should also be installed. Chasers that are dull tend to cut faster or increase the lead of the thread; therefore, if the chasers are not ground frequently and the lateral movement between the lead-screw and the lead-screw nut is not kept to a minimum, lead errors will gradually develop as the chasers become dull.

At all times, thread-cutting equipment should be kept in a good state of repair. All excess wear should be eliminated by adjustments, for which provision is usually made. Die-heads should be dismantled and cleaned periodically, and, of course, repaired when necessary to insure proper operation.

The preceding suggestions have been made with the object of promoting better performance of die-head and threading machine equipment. There are, of course, many factors that enter into the production of accurate threads of good quality; but if these basic reasons for poor threading equipment performance are closely checked, the users of such equipment will consistently obtain threads of better quality, higher production rates, and lower thread-cutting costs.

Table 2. Lubricants Recommended for Thread Cutting with Dies

Material to be Threaded	Lubricants Recommended for Threading Operation
Vanadium Steel.. Nickel Steel ..... Tool Steel ..... Open-hearth Steel. Machine Steel ... Bessemer Steel .. Screw Stock ..... Merchant Pipe ... Seamless Tubing .	A heavy sulphur-base oil will give the best results, due to its cooling efficiency. On the freer cutting steels, mineral oil or paraffin oil can be used when sulphur-base oil is objectionable.
Cast Iron ..... Malleable Iron ..	Mineral lard oil or compound of a mixture consisting of 40 gallons water, 10 gallons mineral lard oil and 2 1/2 pounds of soda ash. Another good coolant is 75 per cent kerosene and 25 per cent paraffin oil.
Phosphor Bronze. Copper ..... Drawn Brass .... Aluminum ..... Lead	Mineral lard oil diluted with 30 to 40 per cent kerosene
Cast Brass ..... Hard Rubber .... Fiber ..... Bakelite	Dry

* * *

Arc Welding Reduces Cost of Refacing Worn Car-Wheel Flanges

A simple layer-on-layer arc-welding process is said to account for a 50 per cent saving in the cost of refacing abrasion-worn flanges of car wheels in the repair shops of the Philadelphia & Western Railway Co. According to the General Electric Co., the flanges can be refaced approximately four times by this process before the treads of the wheels become worn to the point where they are scrapped. The treads are not refaced, because of the possibility of fracture produced by shrinkage stresses.

In inspecting the wheels at regular intervals, a templet conforming to the contour of a new unused wheel is placed on the flange and tread of each wheel. If comparison with the templet indicates that the wheel is worn beyond a certain point, the wheels are taken off the truck and placed on a support which facilitates the rebuilding of the flanges. The wheels are refaced separately, but a special holding and turning mechanism permits two of the refaced surfaces to be ground at one time before the wheels are reassembled on the truck.

Before being welded, the wheels are preheated with a blow-torch to 350 degrees F. Then, using 1/4-inch electrodes with approximately 250-ampere direct current, straight polarity, a single-layer bead of metal is welded with a weaving motion on the worn surface around the entire circumference of each wheel. After all slag and spatter have been removed by light grinding, a second and a third, and if necessary, a fourth layer are added, each layer covering a little more of the flange until it is built up to its proper height as determined by the templet.

Materials of Industry

THE PROPERTIES AND NEW APPLICATIONS OF MATERIALS USED IN THE MECHANICAL INDUSTRIES

New Nylon Plastic with High Softening Point

A new plastic is being manufactured by E. I. du Pont de Nemours & Co., Inc., Wilmington, Del., which has Nylon as a base. It is characterized by a softening point of 450 degrees F., compared with about 160 degrees F. for most thermoplastic materials and about 280 degrees F. for the highest previous limit in such material. This high softening point approaches that of thermosetting materials, and tends to overcome a disadvantage of the thermoplastics while retaining their advantages.

The new material is one of the lightest plastics in weight. It burns slowly; undergoes little or no deterioration with age; is only slightly affected by sunlight; resists oil, grease, solvents, alkalies, and weak acids; is easily machined; has good electrical properties. It also has the advantage that it can be molded in existing equipment with minor modifications.

Bearings of Nylon plastic have been made and are now undergoing extensive tests. Industrial coil springs are also expected to be another Nylon plastic product that will be developed after the war. 201

Corrosion Protection for Zinc and Cadmium Surfaces

A compound for treating zinc- and cadmium-plated surfaces, zinc die-castings, and galvanized steel so as to provide a corrosion-resistant coating has been developed by Rheem Research Products, Inc., 2523 Pennsylvania Ave., Baltimore 17, Md. This compound, designated "Iridite," is supplied in the form of a solution. The part to be treated is immersed in the solution for from ten to sixty seconds at a temperature of 75 to 100 degrees F., after which it is subjected to a brief hot-water rinse, which completes the process.

The solution reacts with the zinc or cadmium surface to form a uniform opaque olive-drab coating. Products so treated, when submitted to various salt spray tests using a 20 per cent sodium-chloride solution at 95 degrees F., show a considerable increase in corrosion resistance. Thus, it has been found that while zinc surfaces ordinarily stand up from ten to fifty hours in salt spray tests, the Iridite process increases their life about three times. 202

Combined Rust Preventive, Cleaner, and Fingerprint Neutralizer

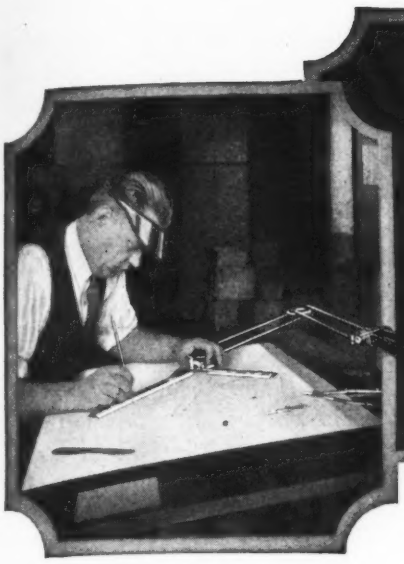
A combined rust preventive, cleaner, and fingerprint neutralizer has been announced by E. F. Houghton & Co., Philadelphia, Pa., for use in the protection of steel parts between processing or machining operations. This product, known as Cosmoline No. 805, is not intended to remove rust, but rather to neutralize the causes of corrosion, particularly the acid perspiration that comes from handling the parts. It is also effective in protecting metal surfaces against corrosion caused by chemical atmosphere, fumes, or high humidity. The compound is a fluid product that conforms to the requirements of Ordnance Technical Manual TM 38-305. It will meet and exceed 24-hour salt spray and 100-hour humidity tests. 203

A High Impact-Strength Bakelite Plastic

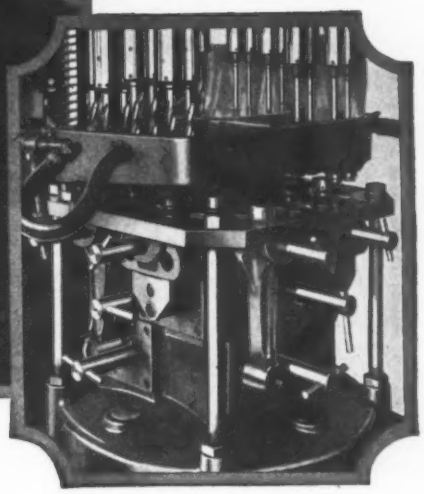
A new, high impact-resistant molding material has been announced by the Bakelite Corporation, Unit of Union Carbide and Carbon Corporation, New York City. This plastic, designated BM-16468, has a string filler rather than the chopped fabric that is employed for other types of shock-resistant plastics. Its impact strength is about twenty to twenty-five times greater than that of general-purpose phenolics.

Additional physical properties comprise a compressive strength of from 27,500 to 32,700 pounds per square inch; a tensile strength of from 7500 to 8500 pounds per square inch; and a flexural strength of from 12,000 to 12,900 pounds per square inch. The impact strength is 3.49 to 4.84 foot-pounds per inch of notch, Izod. 204

To obtain additional information on materials described on this page, see lower part of page 176.



Design of Tools and Fixtures



Dies for Producing Gripper Pad for Printing Press

By HAROLD E. MURPHEY, Westerly, R. I.

The dies shown in Figs. 1 and 2 are being successfully employed in producing the printing press gripper pad shown in the upper left-hand corner of Fig. 2. It was found that the blanking, piercing, and forming operations required to produce this piece could be performed most efficiently and economically by employing the two dies of simple design illustrated.

The stock for the gripper pad is cut up into long strips, 15/16 inch wide, as indicated by the dot-and-dash lines at *S*, Fig. 1, and is fed into the die through the recess *J* in the stripper plate *E*. The first piece punched will, of course, be

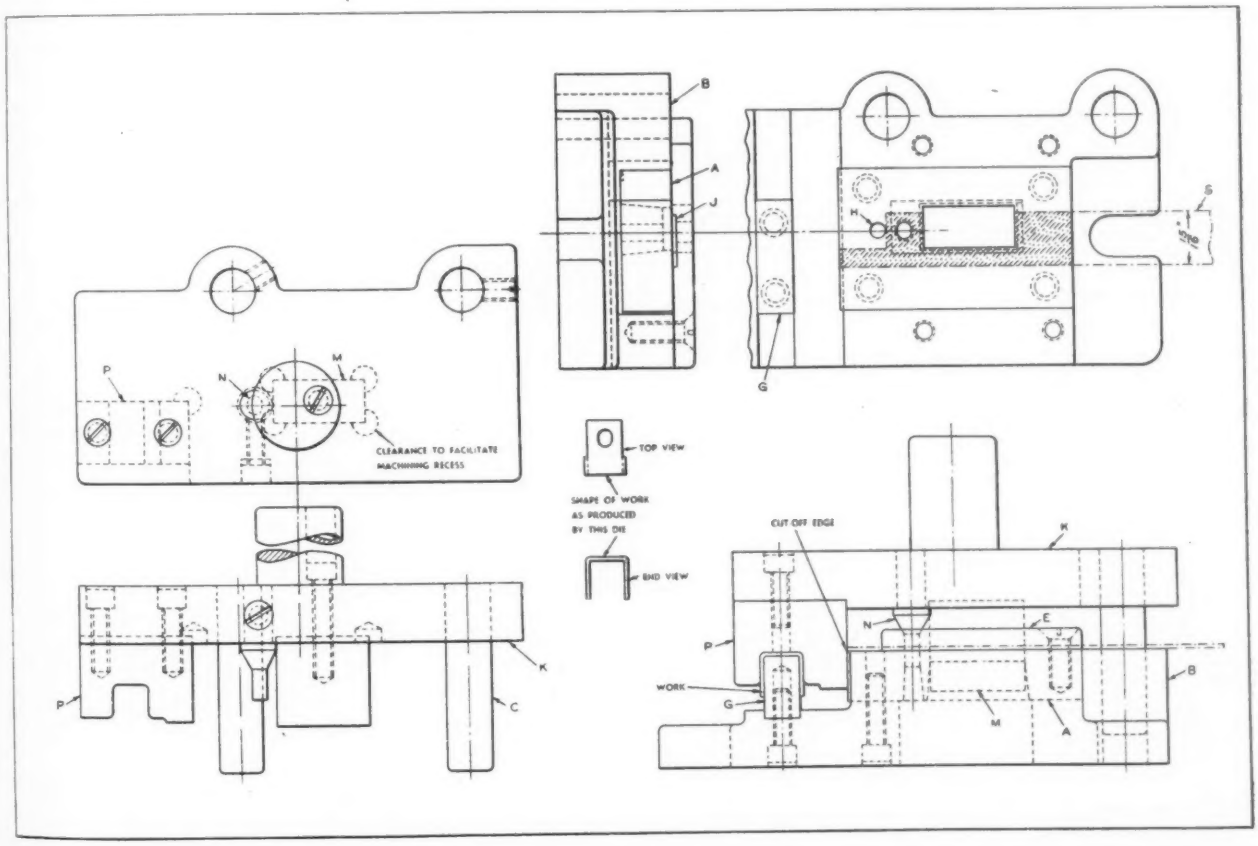


Fig. 1. Blanking, Piercing, and Forming Die for First Operation on Printing Press Gripper Pad

scrap material, but from then on, a semi-finished piece is obtained at each stroke of the press ram.

The shape of the work as produced by the rectangular punch *M* and the oblong punch *N* is shown by the dot-and-dash cross-hatched section. The blank that precedes the one shown cross-hatched is cut off on the same down stroke of the ram by the cutting-off edges of die *A* and forming punch *P*. Continued downward movement of punch *P* forms the blank to a U-shape over the forming block *G*. The semi-finished piece thus produced is shown by the top and end views at the center of Fig. 1.

The stripper plate *E*, which strips the work from the punches on the upward stroke of the ram, is held to the cast-iron die-block *B* by four 3/8–16 flat-head machine screws. The hardened tool-steel die *A* is held in die-block *B* by four 3/8–16 Allen socket-head cap-screws, as shown. Besides the rectangular hole and the oblong hole in this die, there is also a work stop-pin *H*, which locates the stock as it is fed into the die. The forming die or block *G*, which is also hardened tool steel, is secured in place by two 3/8–16 socket-head cap-screws.

Die *A* is extended 1/32 inch beyond die-block *B* to form the cutting-off edge. Dowel-pins are employed for fastening die *A* to die-block *B* to insure accurate alignment. The punch-block *K* has two pilot-pins *C* which keep it in accurate alignment with die-block *B*. The punches in this block are all hardened tool steel, and are held in place by socket-head cap-screws.

It will be noticed that the forming and cutting off punch *P* has a 1/16-inch lip cut in the bottom surface. This allows the work, which is 16-gage metal (or 1/16 inch thick), to be cut off just before the forming operation takes place. It will also be noticed that the rectangular punch *M* is longer than the oblong punch *N*. This enables punch *M* to keep the work strip from "creeping" while the preceding piece is being cut off. The lower right-hand view of the punch- and die-block shows the punch member in its lowest position. The upper right-hand view shows the complete die-block with stripper *E* removed. At the left of this view is shown the end view with the stripper in place. In the lower left-hand corner is shown the complete punch-block with the punches and pilot-pins in position.

After the work has been blanked, pierced, and formed, as indicated by the end and top views, Fig. 1, it is transferred to the second-operation die shown in Fig. 2, which consists of the steel block *C*, the forming fingers *D*, tension springs *E*, forming finger pins *F*, punch-block *A*, and punch *B*. The work, as it comes to this die from the first-operation die, is placed in die *C* with the two legs uppermost and in contact with fingers *D*, as shown in the view in the lower right-hand corner. The forming mandrel *G* is then placed in the steel block *C* as shown, and held in place by hand. The press is now tripped, the round or square punch *B* descends and hits forming fingers *D*, pushing them down on the two ends of the work and thus forcing the ends of the work over and down on the forming mandrel *G*. This completes the forming operations on the gripper pad.

As the ram of the press moves upward on the return stroke, the forming fingers are released and returned to their open positions by tension springs *E*. The work is then taken from the die and the mandrel *G* removed, thus completing the work on the gripper pad so far as the dies are concerned (see three views of finished piece in Fig. 2).

The final operation on the pad consists of driving a piece of leather into the opening produced by the final forming operations. This piece of leather extends 1/16 of an inch above the metal, thus forming a seating surface for the printing press gripper.

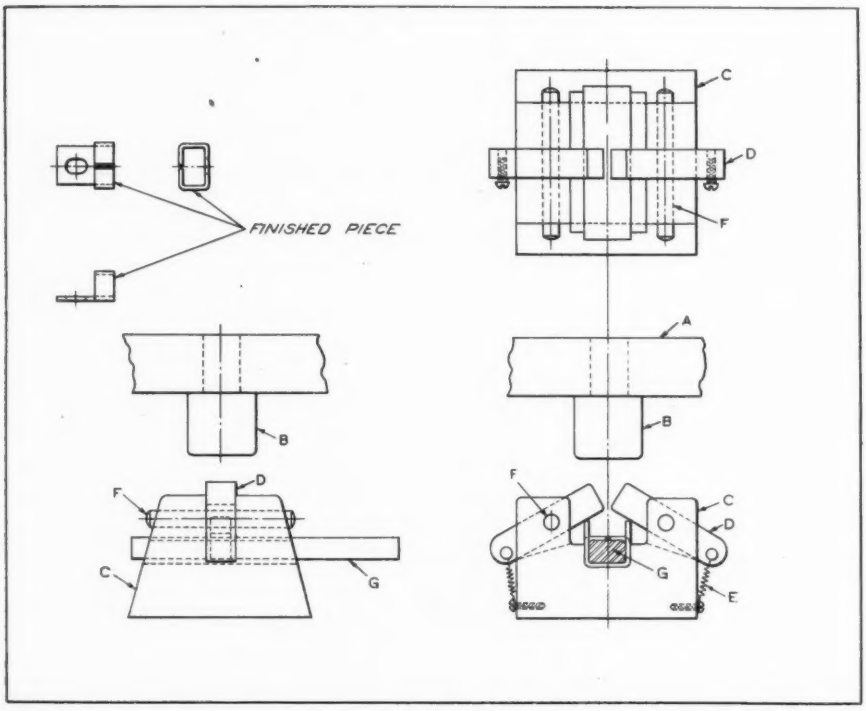
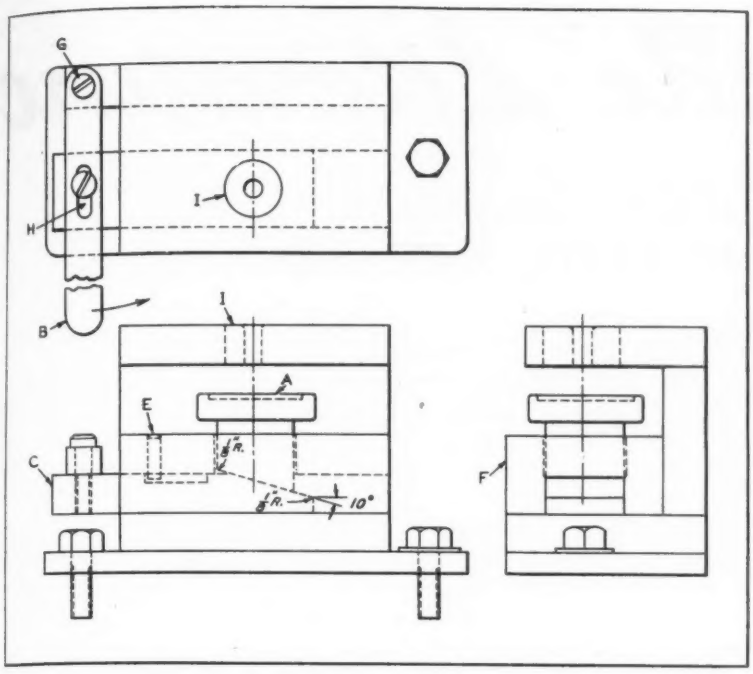


Fig. 2. Die Employed for Final Forming Operation on Gripper Pad



Drill Jig Designed for Quick Loading

Nest Type Drill Jig Designed for Quick Loading

By ALEX S. ARNOTT, Toronto, Ontario, Canada

A quick-loading jig designed for use in drilling blind holes in small parts is shown in the accompanying illustration. The piece to be drilled is placed on the member *A* in a recess or nest machined to insure accurate positioning. The body of member *A* is made a sliding fit in the jig, as gravity is depended on to return it to the normal loading position.

The jig is made from machine steel and can be of welded or doweled construction. It is held to the machine table by two standard bolts. The wedge-shaped bar *C*, operated by handle *B*, lifts the member *A*, clamping the work against the upper member, which holds the drill bushing.

The block *F* has a slot milled through it for the bar *C*. It also holds the member *A*, acting as a guide for both bar *C* and member *A*. Handle *B* pivots about the stud *G* on a bracket attached to the jig body. It has a slot at *H* through which a shoulder screw is fastened to bar *C*. Pin *E* serves to restrict the movement of bar *C*.

To operate the jig, the work is simply placed in the nest *A* and the handle *B* moved in the direction indicated by the arrow, which moves *C* in the same direction and causes the part *A* to rise vertically until the work is clamped securely in place. The operator holds the handle in this position with the left hand, while the drill is being fed with the right hand. When the drilling operation has been completed, member *A* is lowered and the work removed.

Are We Making Proper Use of the Manpower that We Have?

In an article entitled "You Can't Pay Workers that Much," published in the February number of the *Reader's Digest*, a representative of the Treasury Department in Washington is quoted as saying, "A man who works with his hands should not be paid as much as $5000 a year." This statement was made in connection with the incentive payment plan of the Lincoln Electric Co., Cleveland, Ohio, which has enabled workers in that plant to earn more than $5000 a year through hard work and application to their job.

The Lincoln Electric Co. has received a great many letters from workers all over the country commending the company for giving a worker an opportunity to apply himself to his job to his fullest ability, and paying him in proportion to the amount of work produced. In these comments, some of the workers call attention to the fact that, in a great many plants throughout the country, workers are not permitted to work to the full extent of their ability, this doubtless being due to union regulations and restraints. The recent case in one of the Ford plants will be recollected, where a strike was precipitated because two men had shown themselves capable of unusual accomplishments in the amount of work performed.

One worker in an eastern aircraft factory writes to the Lincoln company: "I am not allowed to produce half the work I am capable of; and when I find easier and faster methods of turning out work, I find it only allows another worker to loaf. I honestly believe an incentive pay system instituted in this plant would increase production 100 per cent without hardship to any person."

Another aircraft worker from California writes: "I really would like to see your policy carried out everywhere, especially out here. The labor waste is terrible and it's a shame, as badly as we need planes, especially in the Pacific."

* * *

Unless the tax burden upon people with incomes that are above the living cost level is lessened, one result of the war will be that most of the incomes of those who would otherwise be able to invest capital in business enterprises will be drained away.—*Stevenson, Jordan & Harrison, Inc.*

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E. F. HOUGHTON & Co., 303 W. Lehigh Ave., Philadelphia 33, Pa. Booklet containing information on the correct lubricants for various types of gears, together with instructions on proper lubrication maintenance. 3

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ERICKSON STEEL CO., 2309 Hamilton Ave., Cleveland 14, Ohio. Bulletin E, descriptive of Erickson precision collet chucks. 46

Care of Electrical Equipment

SQUARE D CO., 6060 Rivard St., Detroit 11, Mich. Booklet entitled "Care and Maintenance of Electrical Equipment." 47

Plastics

B. F. GOODRICH CO., Chemical Division, Akron, Ohio. Circular containing information on Geon resins and plastics. 48

Magnetic Polishing Lathes

LIMA ELECTRIC MOTOR CO., Lima, Ohio. Bulletin illustrating and describing the Lima magnetic polishing lathe. 49

Plastics

RICHARDSON CO., Melrose Park, Ill. Catalogue containing design suggestions relating to molded and laminated plastics. 50

Grinding-Wheel Dressers

AMERICAN STANDARD CO., Southington, Conn. Bulletin 602M, on the use of Jiffy diamond wheel-dressers. 51

To Obtain Copies of New Trade Literature

Which of the new or improved equipment described on pages 177-210 is likely to prove advantageous in your shop? To obtain additional information or catalogues about such equipment, fill in below the identifying number found at the end of each description—or write directly to the manufacturer, mentioning machine as described in April, 1944, MACHINERY.

No.	No.	No.	No.	No.	No.	No.	No.	No.	No.

Fill in your name and address on other side of this blank.

To Obtain Additional Information on Materials of Industry

To obtain additional information about any of the materials described on page 170, fill in below the identifying number found at the end of each description—or write directly to the manufacturer, mentioning name of material as described in April, 1944, MACHINERY.

No.	No.	No.	No.	No.	No.	No.	No.	No.

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Detach and mail to MACHINERY, 148 Lafayette St., New York 13, N. Y.

[SEE OTHER SIDE]

Shop Equipment News

Machine Tools, Unit Mechanisms, Machine Parts, and Material-Handling Appliances Recently Placed on the Market

Landis Centerless Grinding Machine

The Landis Tool Co., Waynesboro, Pa., has just announced a No. 12 centerless grinding machine adapted for through-feed, in-feed, and end-feed operations. When formed pieces are being ground by the in-feed method, a profile bar can be used. A large handwheel with a micrometer dial can be set for work-diameter reduction in steps of 0.0001 inch.

The regulating wheel base of this new machine is completely self-contained, the drive to the spindle being from an adjustable-speed motor through multiple V-belts. With this arrangement, an infinite number of regulating wheel speeds can be secured with no interruption of the grinding cycle by merely turning a control knob at the front of the machine bed. One of the outstanding features is the hydraulically operated regulating wheel cross-slide, designed to facilitate dressing the wheel face by traversing it across the point of a rigidly held diamond.

In through-feed grinding, no readjustment of the dresser is required when the angular position of the regulating wheel base is changed. The hydraulically operated cross-slide provides means for accurately aligning the work-rest blades. The regulating wheel base can be traversed by means of a screw adjustment at the front of the bed, as well as by hydraulic means, which permits quick axial alignment of the regulating wheel with the grinding wheel. The regulating wheel base can be swiveled to permit grinding tapers. Thus, no expensive wheel loss due to unnecessary truing of the regulating wheel occurs when changing from one taper to another or when changing from a straight to a taper surface, or vice versa.

The grinding wheel base, like the regulating wheel base, is completely self-contained, and has a multiple V-belt drive to the grinding wheel spindle. The Landis "Microsphere" wheel-spindle bearings are used for both the grinding wheel spindle and the regulating wheel spindle. The rigid work-rest is mounted on the machine bed. A series of elevating screws is provided under each end of the work-rest blade to facilitate setting up the machine for through-feed grinding.

The main controls are grouped at the front of the bed within easy reach of the operator. They include a master starting button and a master stopping button for all electric motors and a three-stage motor switch for selecting a work set-up stage, a grinding stage, or a dressing stage. The regulating wheel speed automatically increases for the dressing operation when the selector switch is turned to the dressing stage position, and automatically slows down to the grinding speed when the selector switch is returned to the grinding stage position. The two wheel-dressers are controlled by two large knobs.

There is a built-in 60-gallon coolant reservoir with baffles for settling the sediment, and a one-shot lubrication system. All electric control equipment is mounted in a separate, fully enclosed compartment in the bed. The weight of the machine, including electrical equipment, is 8000 pounds. A 15-H.P., constant-speed motor is used to drive the grinding wheel.....61

Centerless Grinding Machine Brought out by the Landis Tool Co.

To obtain additional information on equipment described on this page, see lower part of page 176.

Ferracute Open-Back Inclinable Press

The Ferracute Machine Co., Bridgeton, N. J., has recently added a 150-ton C 36 1/2 press to its improved line of open-back inclinable presses. This press is of the geared type with jaw clutch but can be had with pneumatic friction clutch and brake. The press frame casting is made of steel and the heavily stressed parts of a special high-tensile semi-steel to reduce the weight of the press and the floor space required without sacrificing strength and rigidity.

The stroke ranges from 6 to 13 inches. The bed is 32 inches front to back by 50 inches right to left. Improved features include built-in ram balance and anti-friction bearings in a removable sleeve. Operations which can be performed efficiently and economically include shallow forming, blanking, and punching. The entire series of inclinable presses comprises fifteen sizes with shafts ranging from 1 1/4 to 7 inches in diameter. The presses can be had with various special features that permit them to operate automatically or with finger-tip controls. 62

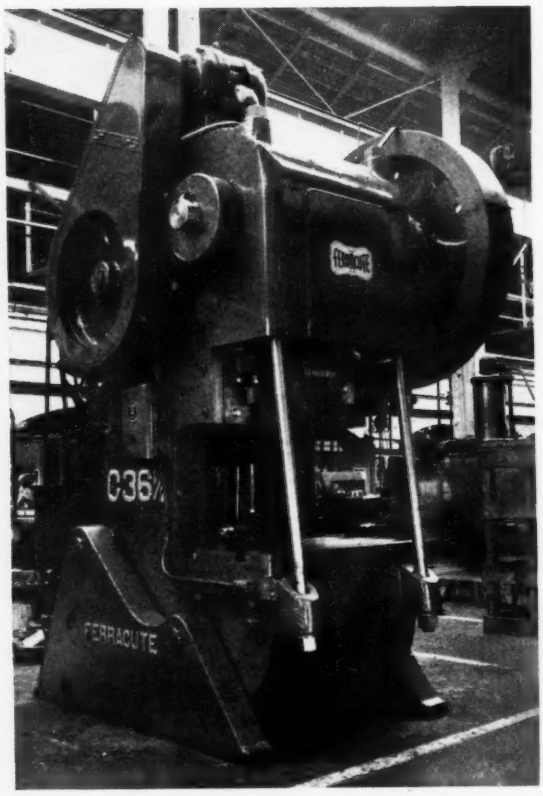
Cincinnati Hydromatics Equipped for Profile Milling

Tracer-controlled Hydromatic profile milling machines in a wide range of sizes and in plain and duplex styles have recently been added to the line built by the Cincinnati Milling Machine Co., Cincinnati 9, Ohio. These new machines are of the same basic structural design as the standard Cincinnati Hydromatic line of heavy-duty production types, but have a sensitive tracer-controlled vertical movement of the spindle-carrier. With this control, accurate duplication of master profile templets is obtained automatically without attention on the part of the operator. Automatic table cycles, synchronized with the spindle-carrier vertical movements, reduce the work of profile milling to loading and unloading of the work-holding fixtures.

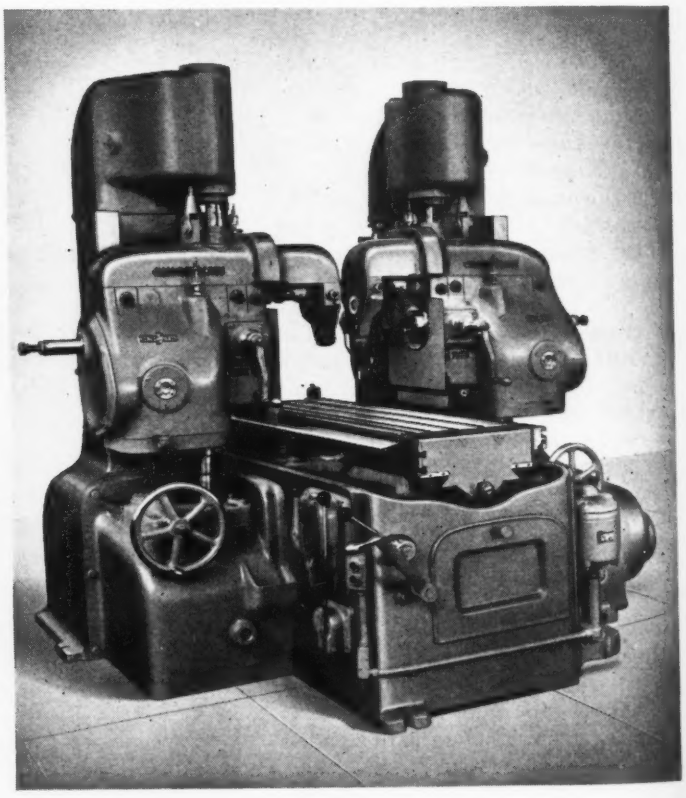
The automatic hydraulic tracer mechanism, mounted on the spindle-carrier, controls the vertical position of the latter member during the cutting stroke of the table. As the table moves, a roller on the end of the tracer-valve mechanism travels along the top of the master profile templet attached to the work-holding fixture, and any vertical movements of the tracer valve are automatically duplicated by the spindle-carrier. Contact pressure between roller and templet is naturally very light, since the roller has only to actuate the hydraulic control valve.

Table and spindle-carrier movements are automatically synchronized in such a way that the spindle-carrier must be in its uppermost, or retracted, position before the table can move at the rapid traverse rate, and must be in the lowered, or cutting, position before the table can move at the feed rate. This arrangement provides automatic vertical advance and retraction of the cutter for taking blind end milling cuts by automatically lowering the cutter behind obstructions in the work or fixture.

An automatic variable-feed attachment, available as extra equipment, provides automatic cam-controlled variations in the feeding rate to permit constant maximum metal removal, regardless of width and depth of cut. The selector

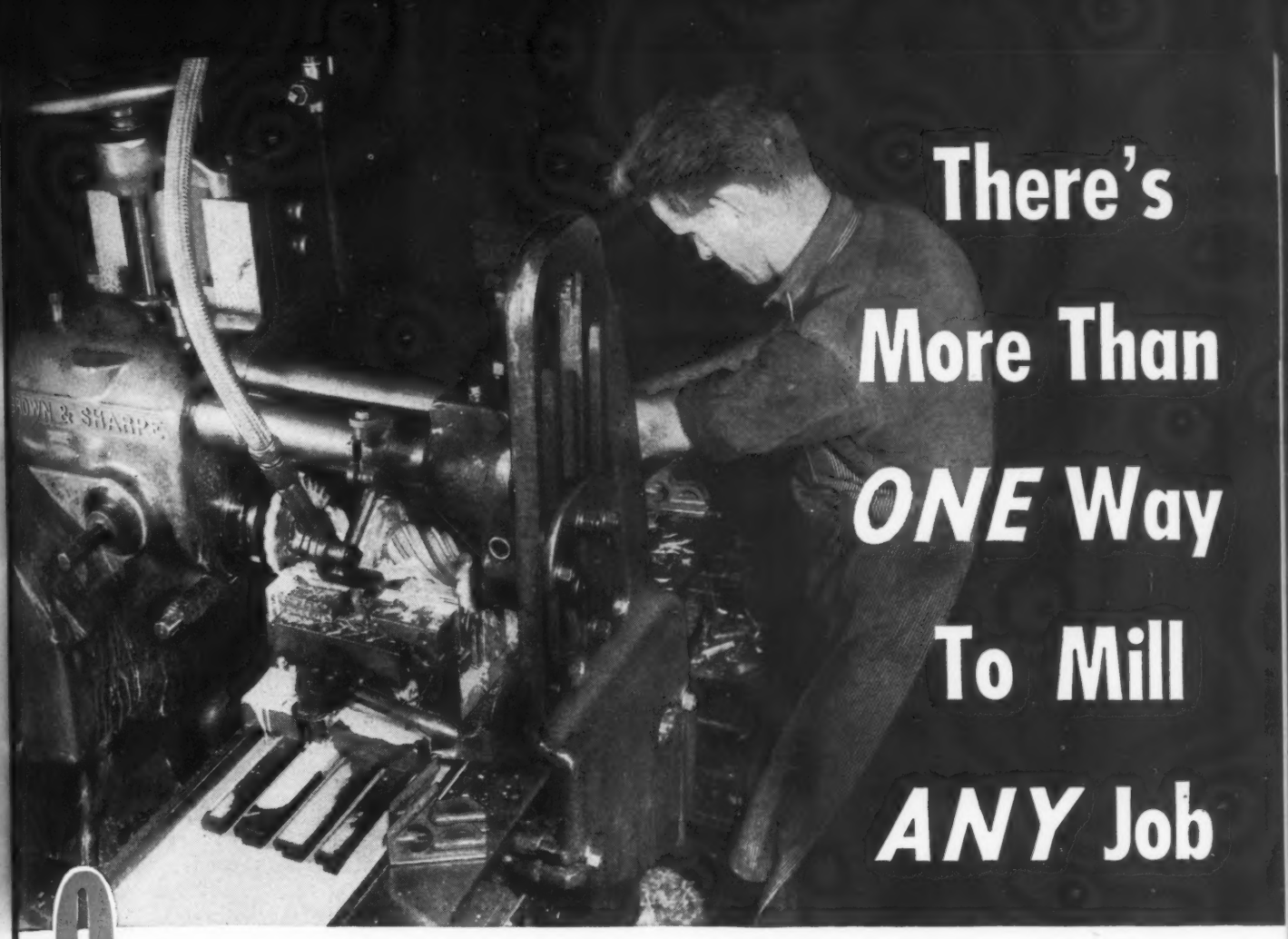


Open-back Inclinable Press Recently Added to the Line Built by Ferracute Machine Co.



Cincinnati Duplex Hydromatic Equipped with Tracer Control for Profile Milling

To obtain additional information on equipment described on this page, see lower part of page 176.



There's More Than *ONE* Way To Mill *ANY* Job

On the № 12 you can do it the BEST way

ILLUSTRATION — Production jumped 27% when Dual Feed Rate was used on this double-fixture job employing an automatic cycle automaticaly repeated.

Also, on No. 12 Plain Milling Machines, Take Advantage of . . .

DUAL FEED RATE — Save on run-in. Reduce cutting time on work having varying stock depth.

ACCURACY OF TABLE CONTROL — Run in close to work in fast travel before dropping into feed; return to fast travel the instant cutter is clear of work. Make blind cuts with consistent accuracy.

Because Machine Provides Choice of These Methods

CONVENTIONAL MILLING — With speeds and feeds available to give maximum stock removal on all materials.

CLIMB MILLING — For those hard-to-hold jobs. Often permits use of higher feeds; with longer cutter life.

ROUGH-AND-FINISH MILLING — Rough by climb milling, finish by conventional milling as table returns — with only one chucking in one fixture. Ideal for formed cuts.

DOUBLE-FIXTURE MILLING— Employs an automatic cycle automatically repeated; eliminates loading time; requires only one set of cutters.

BROWN & SHARPE

valve provides for disengagement of the automatic tracer control, and permits the use of the machine for heavy-duty production work.

The hydraulic table feeds are infinitely variable and are under the control of a single throttle type lever. Since two-way feed cycles are supplied as standard on these machines, cuts can be taken in either or both directions, thereby providing the advantages of continuous production by the reciprocating method of milling. When operating the machine by hand controls for set-up purposes, table feed or rapid traverse movements in either direction are selected by a single four-position directional control lever. 63

Besly Parallel Surface Precision Grinding Machine

Small parts that require accurate grinding of parallel surfaces, such as washers, oil-seals, sides of bearing races, piston-rings, etc., can be ground at high speed on the No. 253 machine shown in Fig. 1 and on the No. 926 machine shown in Fig. 2, recently brought out by Charles H. Besly & Co., 118 N. Clinton St., Chicago 6, Ill. A typical example of production work performed by these machines is the grinding of piston-rings, in which the two grinders are operated as a battery. On such work, the No. 253 grinder, which is a double horizontal-spindle machine with an improved automatic feed, does rough- and semi-finish grinding at the rate of 12,000 pieces per hour. The No. 926 grinder, which is a double vertical-spindle machine, finishes the rings to a tolerance of 0.0002 inch at the rate of 8500 per hour. Since both machines employ wet grinding, warpage of the work from overheating is practically eliminated.

A wide range of work can be ground on the 42-inch machine, shown in Fig. 1, when equipped with various types of fixtures. Among the fixtures used are the semi-automatic roll-feed; semi-automatic rotary fixtures with multiple-station solid or segmental feed wheels; power oscillating fixture; and hydraulic reciprocating planer type table, mounted on a base between the grinding wheels, on which work-holding fixtures can be attached. The machine is regularly equipped with a vertical bar type wheel-dresser, power-driven with automatic reversing switches and push-button control, and a dresser bar to accommodate diamonds or star cutters.

The 30-inch double vertical-spindle grinder, shown in Fig. 2, finish-grinds to a high degree of accuracy with respect to dimensions, parallelism, and surface finish. It is not intended that this machine remove a large amount of stock, but rather that it take light finishing cuts at high feeding speeds. Usually fine-grain 120- to 320-grit abrasive wheels are used.

The wheel-dressing equipment is similar to that provided on the 42-inch machine. The work-feeding mechanism is of the semi-automatic magazine type, equipped with quick-change endless feed chains. Multiple-station rotary feed wheels, mounted on the vertical spindle, can also be furnished. 64

Synthetic Rubber Cut-Off Disks and Grinding Wheels

The "Radiac" synthetic rubber cut-off disks and grinding wheels recently brought out by A. P. de Sanno & Son, Inc., Phoenixville, Pa., have proved under tests to be superior in many respects to those previously made of crude rubber. These wheels are built to give long wheel life, fast cutting, and good finish, with minimum burning.

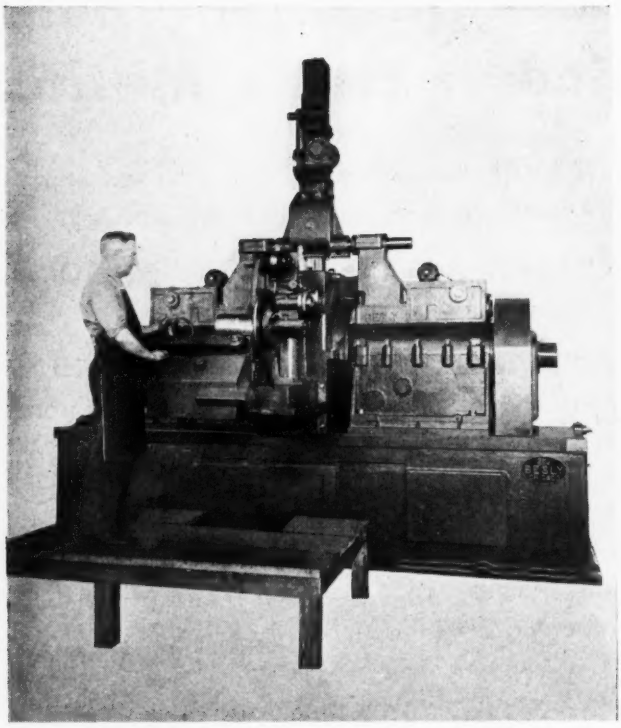


Fig. 1. Besly Double Horizontal-spindle Parallel-surface Rough- and Semi-finish Grinding Machine

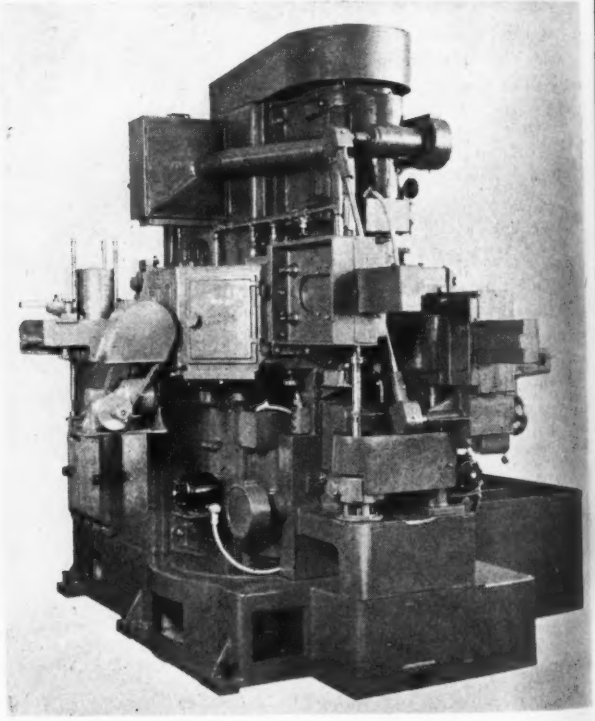


Fig. 2. Besly Double Vertical-spindle Parallel-surface Finish-grinding Machine

To obtain additional information on equipment described on this page, see lower part of page 176.

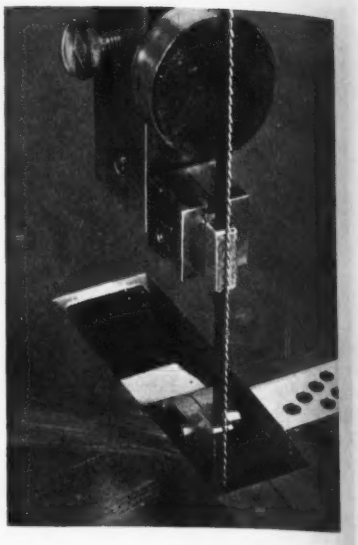
In addition to having better operating characteristics, the new wheels and disks have been improved in appearance and in the quality and uniformity of the bond, structure, and composition. Both the wheels and disks are manufactured in the standard range of thicknesses and diameters up to 20 inches. 65

Grant Double-End Automatic Tapping Machine

The Grant Mfg. & Machine Co., N.W. Station, Bridgeport 5, Conn., has brought out a No. 3 double-end automatic tapping machine of the single-purpose type, which can be adjusted to accommodate work of various lengths and diameters. When equipped with the proper cams and tooling, this machine can be used for hollow-milling, drilling, and threading operations. Both ends of a shaft can be machined simultaneously, provision being made for hollow-milling one end while the opposite end is being drilled or for tapping one end while the other end is being threaded, and for machining the opposite ends parallel to each other.

The milling cutters, die-heads, and tapping heads are fed toward or away from the ends of the work by large drum type cams at the front of the machine. The work rolls into the feeding fingers from the magazine. The cam-operated feeding fingers convey each successive piece of work from the bottom of the magazine guides to a position between the clamping jaws. The forward clamping jaw is advanced by a cam to grip the work, after which the tapping heads advance toward the work. When the tapping is completed, the heads withdraw and the work is automatically ejected and replaced by a new piece. This cycle of operations is repeated automatically.

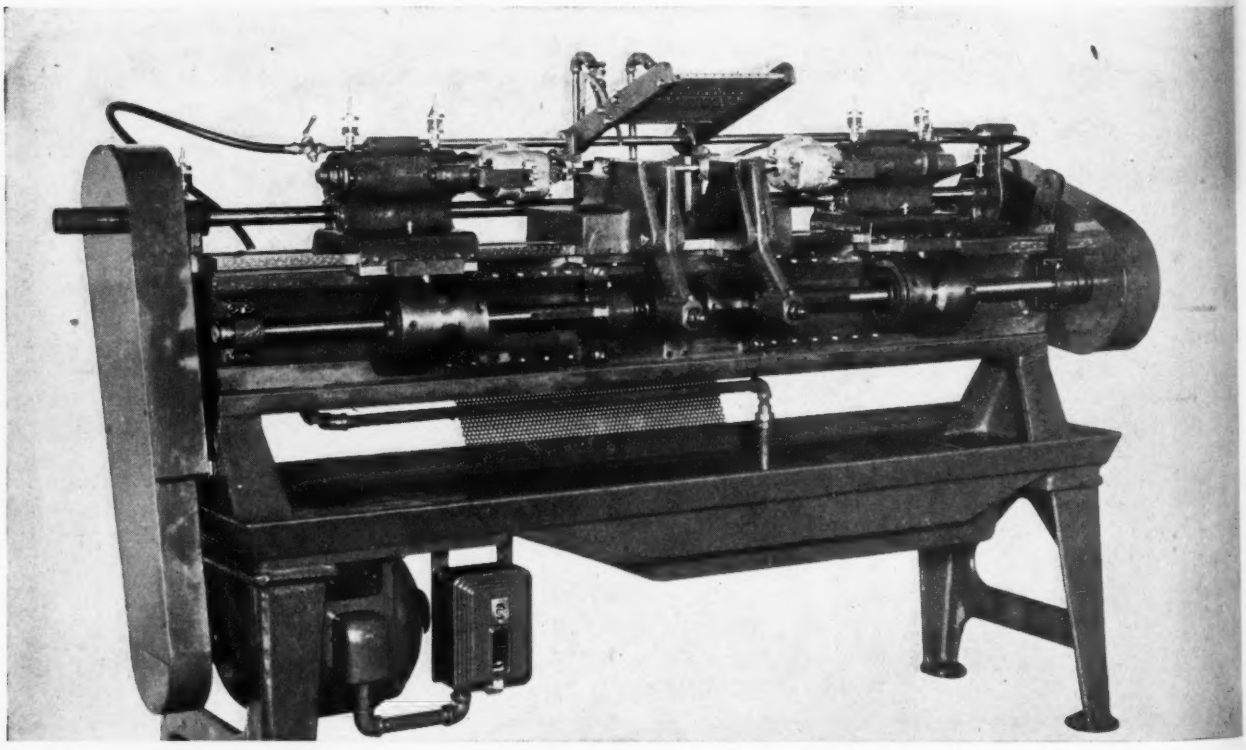
The main drive to the spindles is from a motor beneath the bed. The rate of production varies according to the size of the tap, kind of material, and depth of cut. The machine will take work 3/4 inch in diameter in lengths up to 28 inches for tapping and hollow-milling, and up to 36 inches for external threading. A 3-H.P. motor with a speed of 1150 R.P.M. is required for the drive. Threads up to 3/8 inch can be tapped in steel, and up to 1/2 inch in brass. The machine occupies a floor space of 23 by 85 inches, and weighs about 2450 pounds, boxed. 66



Grob Guides and Lubricator for Band-saw Blade

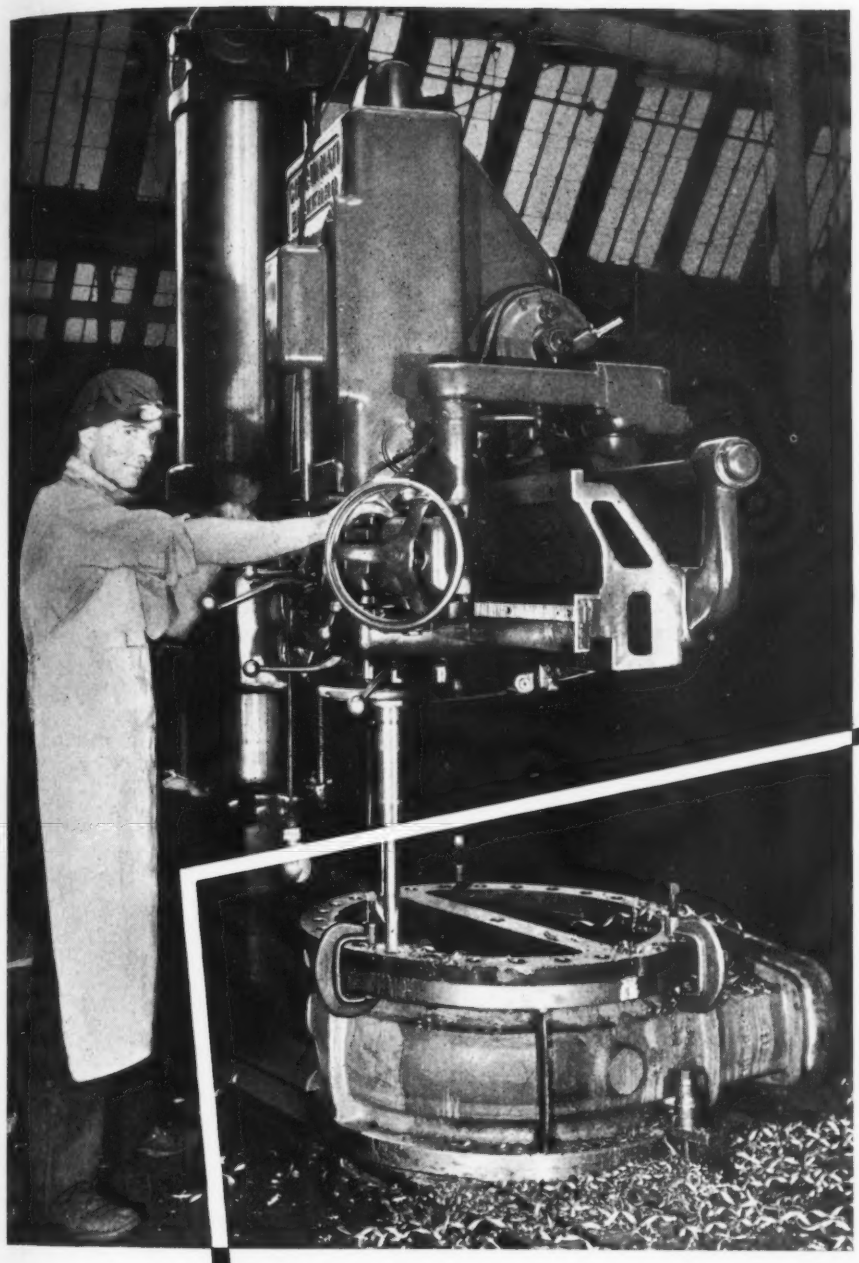
Grob Self-Seating Guides and Lubricator for Band-Saw Blades

Self-seating guides for band saws made from special tough aluminum bronze with a Rockwell C hardness of 34, and a new saw-blade lubricator, are recent developments of Grob Brothers, Grafton, Wis. Long life for the guides is assured by the felt oiler mounted directly above the upper guide, as



Double-end Automatic Tapping Machine Brought out by the Grant Mfg. & Machine Co.

To obtain additional information on equipment described on this page, see lower part of page 178.



. . . and still More Speed

A Radial Drill which responds to the "all out" demands of industry geared to an unprecedented War production is the Cincinnati Bickford Super Service. In numerous plants batteries of these famous Radials are delivering peak production 24 hours a day, 7 days a week —delivering priceless assets of Accuracy and Absolute Dependability. Cincinnati Bickford designs, aimed at "more-holes-per-dollar", are today proving their value.

● Operations Photograph: Courtesy The Darling Valve & Mfg. Co. Drilling 78 holes, 1⅜" dia. through 2 1/16" cast steel. Floor to floor time 103 min. "More-holes-per-dollar" design nets savings of 15% over machine previously used on this job.

SUPER SERVICE RADIAL

THE CINCINNATI BICKFORD TOOL COMPANY

OAKLEY, CINCINNATI, OHIO, U. S. A.

shown in the illustration. The new guides, one above and one below the work, permit heavier pressures to be applied to the saw blade, thus making possible faster cutting.

These guides are designed to eliminate undue wear on the rear of the saw blade and to facilitate accurate sawing. The close support provided immediately above and below the work is especially important when narrow blades are being used for contour sawing. The guides also permit quick, easy changing from one width of saw blade to another.....67

Huge Hydraulic Press for Forming Powdered-Metal Tools and Parts

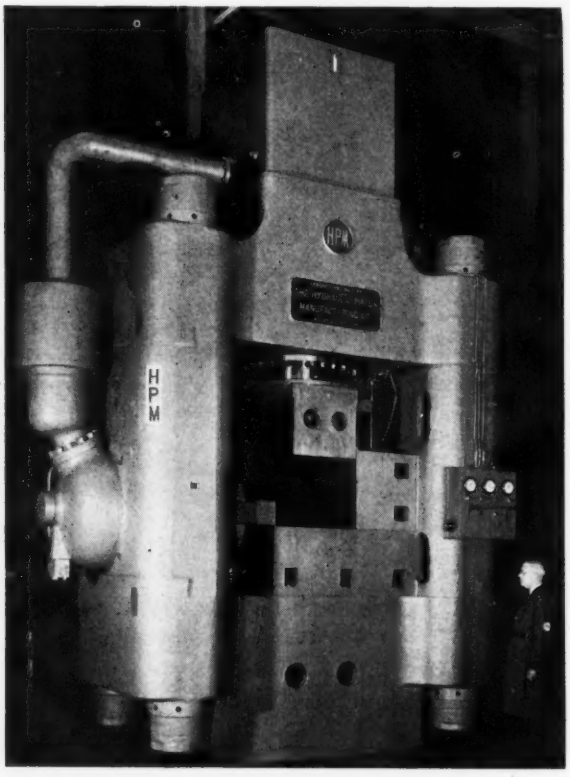
The Hydraulic Press Mfg. Co., Mount Gilead, Ohio, has just completed one of the largest hydraulic presses ever built for use in powder metallurgy. This press was specifically designed for briquetting powdered carbides of tungsten, titanium, or tantalum for carbide cutting tools, dies, and inspection gages, but is also adapted for other powdered metal forming which requires the application of high pressure from two different directions or points. It can be used in the manufacture of a wide variety of parts produced by the powder metallurgy process, which consists of mixing metals in powdered form, pressing them into finished parts, and hardening the parts by sintering.

The tremendous pressure exerted by this machine forms the parts accurately to size, with surfaces that usually require no subsequent machining. Thus many articles made prohibitive by high machining costs can now be turned out on a mass production basis by the powdered metal process. It also makes possible the production of parts that are harder, heavier, or lighter than those made by the usual methods. The powdered metals most commonly used are iron, brass, bronze and steel, but almost any metal commercially available can be employed. Parts with multiple characteristics are obtained by a combination of metals, and in some cases by combining metals and non-metals.

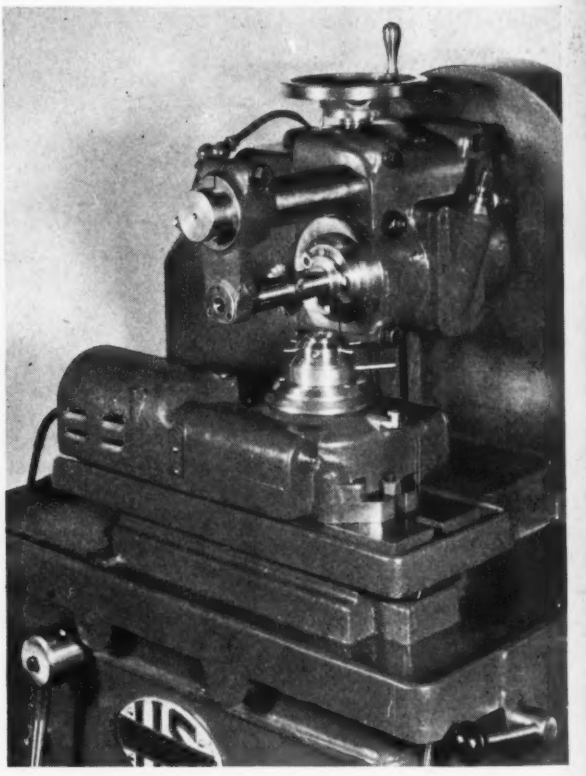
The press shown in the accompanying illustration will exert a downward force of 1500 tons with a maximum ram travel of 18 inches, and a horizontal force of 1000 tons with a ram stroke of 6 inches. The press is completely self-contained, and is equipped with two H-P-M Hydro-Power radial hydraulic pumps which generate the operating pressure. These are directly connected by flexible couplings to the opposite shaft ends of a 30-H.P. electric motor. The hydraulic operating system provides speed and pressure control over all the press movements. The machine is started by an electrical push-button and reverses automatically at a predetermined pressure.....68

Automatic Indexing Fixture for U. S. Multi-Miller

A self-contained indexing fixture having its own motor, which is designed for use on the table of a U. S. multi-miller, has been brought out by the U. S. Tool Company, Inc., Ampere (East Orange), N. J. Standard equipment furnished with the fixture includes one index-plate designed to cover a certain indexing range. Extra plates can be furnished with the fixture to meet any indexing requirements. 69



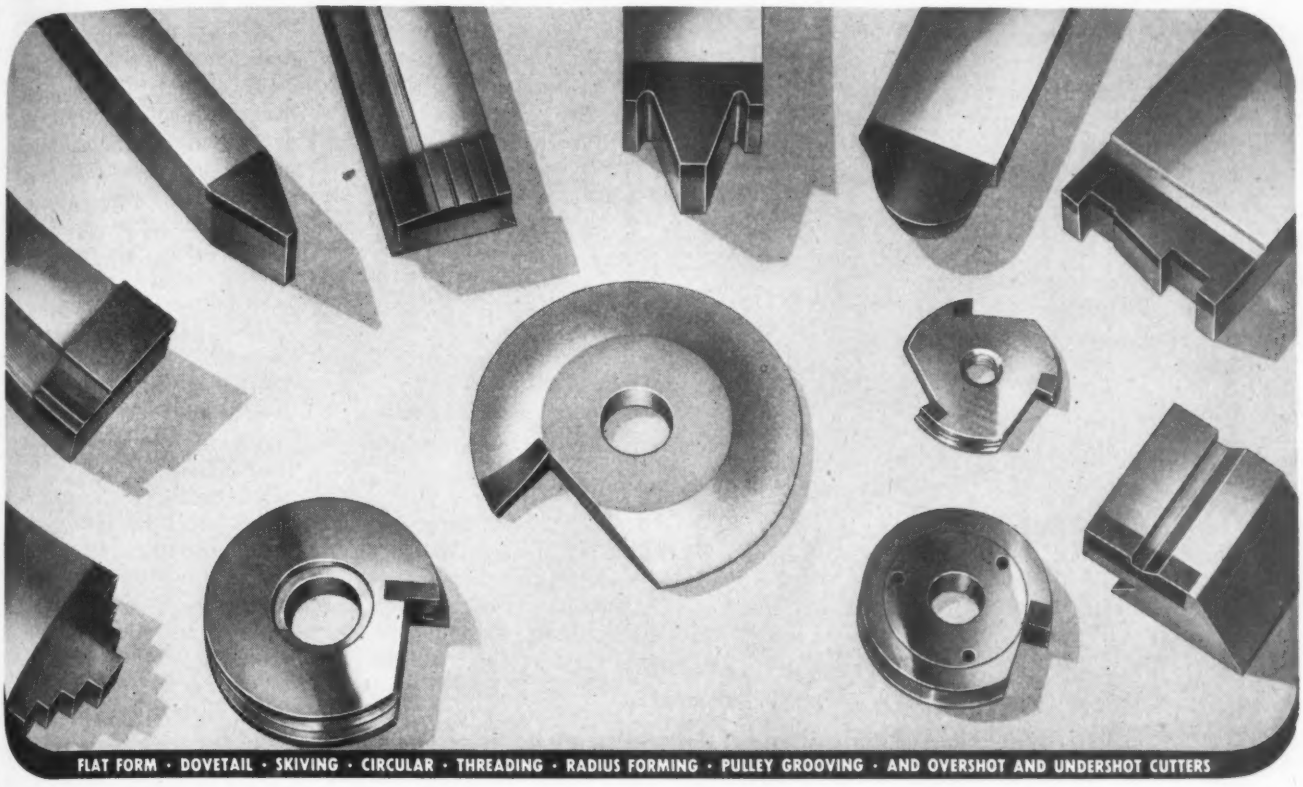
Powerful Hydraulic Press for Producing Cutting Tools and Dies from Powdered Carbides



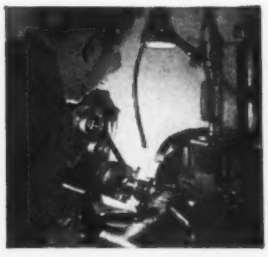
U. S. Multi-miller Equipped with an Automatic Self-contained Indexing Fixture

To obtain additional information on equipment described on this page, see lower part of page 176.

CARBOLOY FORM TOOLS



FLAT FORM · DOVETAIL · SKIVING · CIRCULAR · THREADING · RADIUS FORMING · PULLEY GROOVING · AND OVERSHOT AND UNDERSHOT CUTTERS



COMPLETE FACILITIES FOR FAST, ECONOMICAL PRODUCTION

Complete facilities are provided at Carboloy for the design and manufacture of Carboloy Form Tools of the highest quality, produced with maximum speed and economy. Manufacturing facilities include exclusively-developed equipment for rapid form and exact duplication of the carbide tips, optical grinders that provide —while grinding—constant "microscopic" check and control of area being ground, as well as conventional grinders equipped with specially designed fixtures.

This specially developed equipment, plus expert design service, precision workmanship, and "powder-to-hard-metal" control of Carboloy tip manufacture, combine to provide a form tool service of an unusually high order.

EXPERT DESIGN SERVICE . . . PRECISION WORKMANSHIP

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TRADEMARK

For Cutting CAST IRON and Non-Ferrous Metals

For Cutting STEEL

TUNGSTEN CARBIDES ★★★ TUNGSTEN CARBIDES WITH TANTALUM AND/OR TITANIUM CARBIDES

Denison Hydrostatic Test Press

The Denison Engineering Co., 1152 Dublin Road, Columbus 16, Ohio, recently developed a hydrostatic test press for use in determining the strength of materials, design data, etc. The press is designed to simplify the testing of metals and alloys for drawing qualities, fatigue, and the effect of heat-treatment. It also facilitates comparison of results obtained by different welding methods.

Denison Hydrostatic Test Press

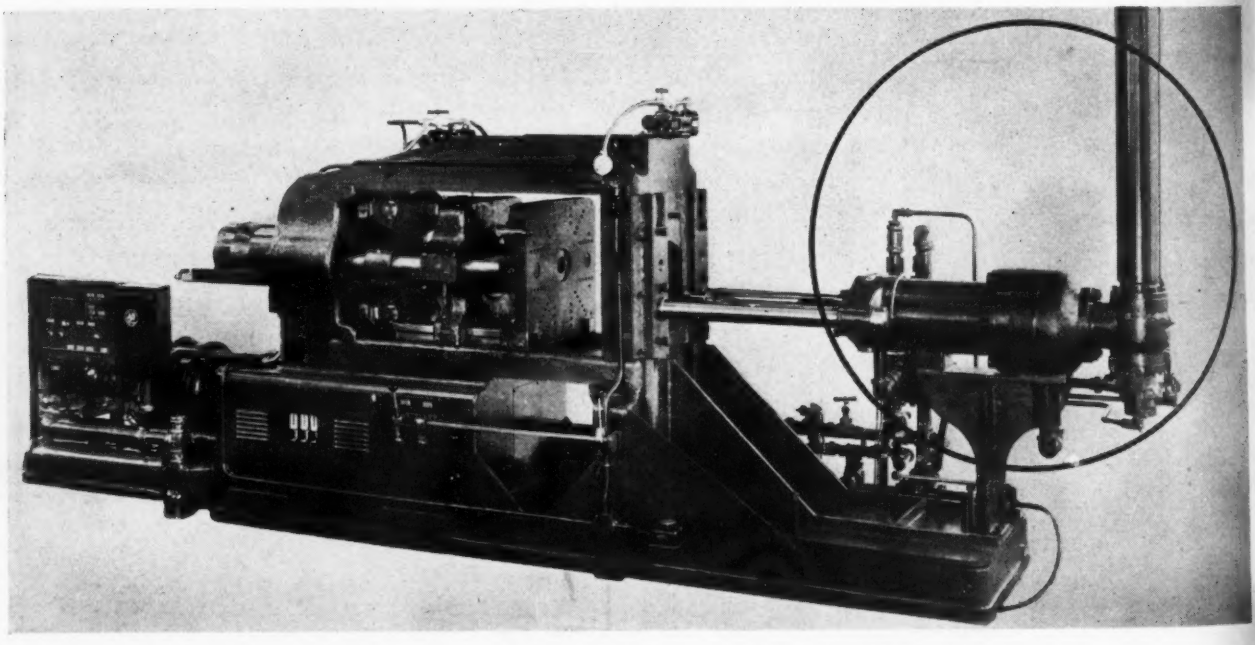
Coatings for metals, such as paints, enamels, and plastics, can be tested by alternate applications of pressure to simulate expansion and contraction. External pressure can be employed to determine the strength of all types of containers. Porosity and seepage values are accurately obtained through uniform application of pressure. The clamping arrangement makes it possible to test articles of various heights without the inconvenience of retooling.—70

Pre-Fill Injection System for Lester-Phoenix Die-Casting Machines

A new pre-fill injection system designed to eliminate hydraulic accumulators on die-casting machines and at the same time improve the quality of the die-castings has been developed by the Lester Engineering Co. for Lester-Phoenix, Inc., 2711 Church Ave., Cleveland 13, Ohio. This new system is now available on Lester-Phoenix high-pressure cold-chamber die-casting machines that are to be used in the production of aluminum, brass, and magnesium alloy parts.

The pre-fill injection system permits stepping up the injection pressure to 33,000 pounds per square inch, as required in the production of 3-pound aluminum castings, and it will hold this pressure while the injected metal chills or solidifies in the die. This is known as the "slow squeeze" injection method, wherein the molten metal is injected into the die slowly, so that air and gases can escape ahead of the metal. After the die cavities are filled, the high injection pressure is applied to the metal as it chills, thereby preventing the formation of shrinkage voids and reducing the volume of any entrapped air or gas to a minimum. If very thin wall sections are required in the production of die-castings of magnesium, which chills rapidly, both the pre-fill system and the accumulator system can be employed.

The pre-fill system equipment consists of a hydraulic cylinder fitted with a large actuating piston, the hollow piston-rod of which contains a passageway to a small inner fixed piston. Oil under a pressure of 1000 pounds per square

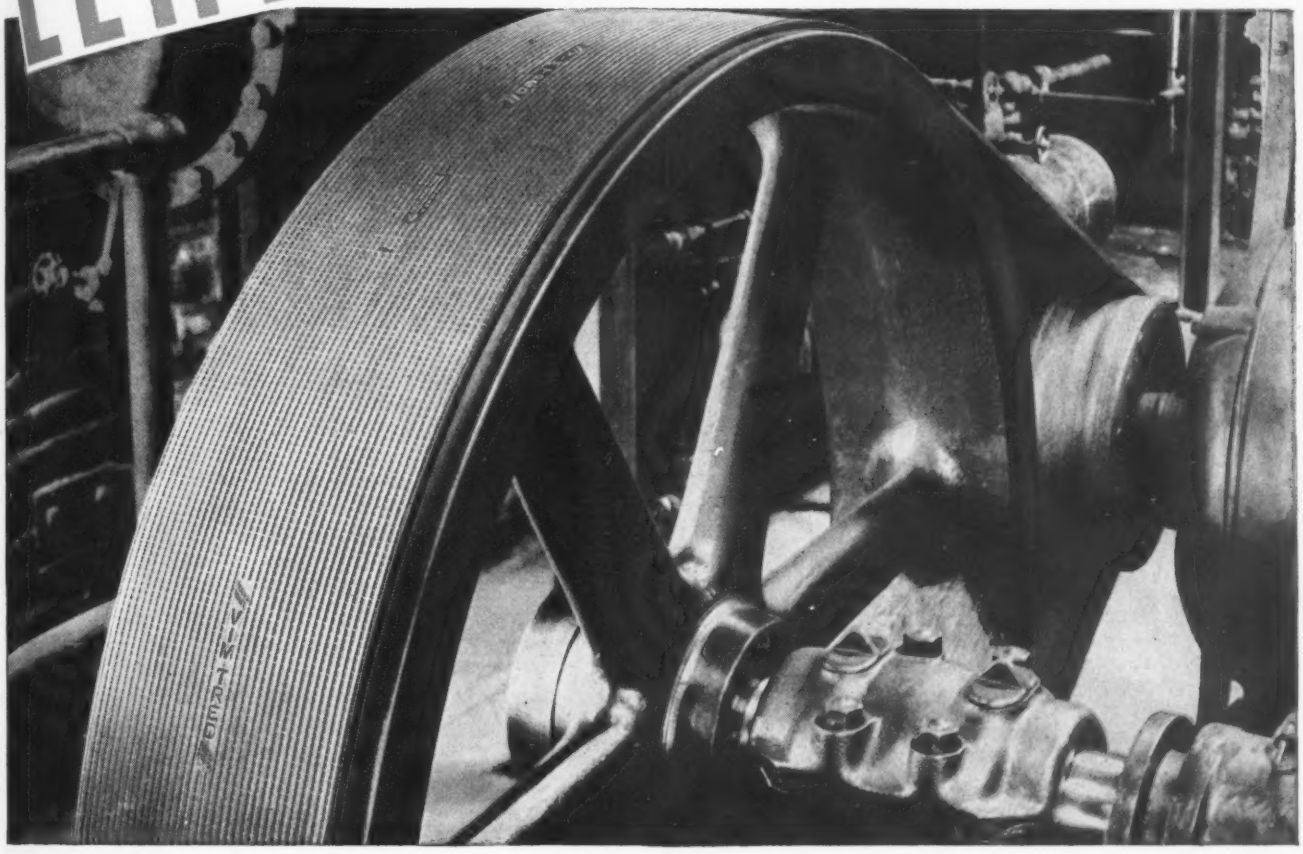


Lester-Phoenix Die-casting Machine Equipped with New Pre-fill Injection System

To obtain additional information on equipment described on this page, see lower part of page 176.

IN BELTING—

LEATHER LEADS!



...IN LONGER LIFE!

Nothing yet has been devised as a power transmitting material to equal the long, useful life of properly tanned leather belting.

Nature gave it the fibrous structure. Science has restored its life by nourishing those fibers after tannage. The result is permanent pulling power, year after year, with only occasional dressing. Insist on first-grade leather!

Houghton's special mineral VIM tannage, as well as its combination OKAY leather, is further improved for grip and pull by adding a patented tread to the pulley side. This tread increases contact tension—minimizes slip.

Other merits—water-and-oil-proof treatment, high C/F, elasticity, pliability, high tensile strength—add up to the greatest value you can get in a power transmission belt. For full proof, write E. F. HOUGHTON & CO., Philadelphia.

HOUGHTON'S

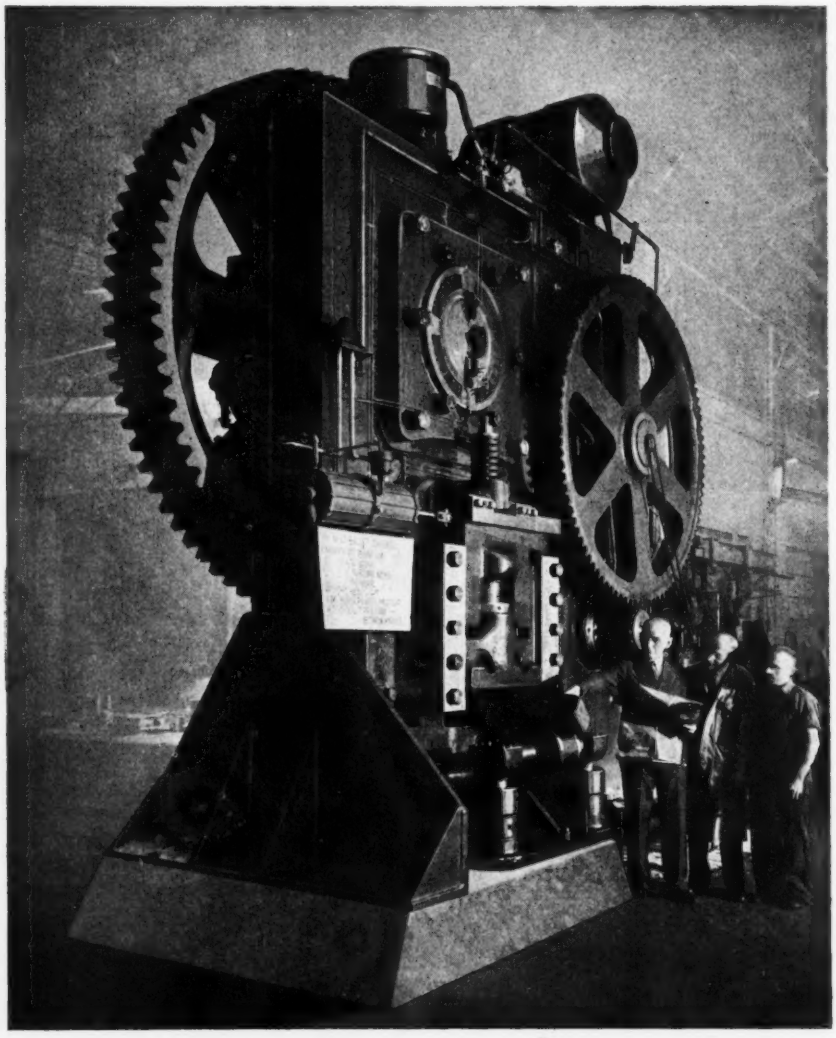
Treaded LEATHER BELTING

inch is introduced through the hollow piston-rod, displacing at high velocity the small piston, which carries with it in its forward movement the piston-rod and the attached main piston. As the latter moves forward at high speed, oil flows from a vertical storage tank through the pre-fill check-valve to occupy the space in back of the large piston. When the die cavities have been filled, an oil pressure of 2000 pounds per square inch furnished by a booster pump is applied to both pistons to give the high final injection pressure.....71

Huge Buffalo Billet Shear

The No. 17 giant billet shear here illustrated was built recently by the Buffalo Forge Co., 440 Broadway, Buffalo, N. Y., to accelerate the production of forged-steel parts at the Melvindale, Mich., plant of the Timken-Detroit Axle Co. This billet shear is believed to be the largest machine of its type ever constructed. It weighs over 80 tons, and has the well-known electrically welded "armor plate" frame construction employed by the Buffalo Forge Co. for more than twenty-five years.

The 4,500,000 pounds pressure exerted on the knives of this press makes it possible to cut 10-inch steel bars at the rate of six cuts per minute. The clutch and hold-down with which this press is equipped are both air-operated. Automatic pressure lubrication is furnished by a lubricator mounted on the machine. The press is operated by a 125-H.P. motor.....72



Buffalo Billet Shear Designed to Cut off 10-inch Steel Bars at the Rate of Six a Minute

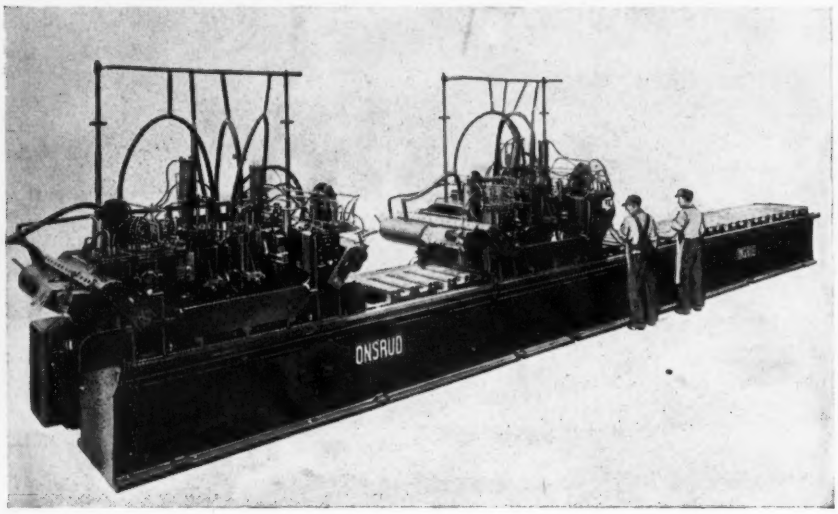
"Micro-Chuk" Used in Horizontal Position as Fixture for Milling Flats

"Micro-Chuk" for Holding Small Parts

A new device known as "Micro-Chuk," designed for holding small pieces for such operations as tapping, threading, cross-drilling, reaming, counterboring, countersinking, milling flats and slots, cutting off, hollow-milling, and straddle-milling, has been placed on the market by the Micro-Master Products Co., 917 W. North Ave., Chicago, Ill. This chuck takes all No. 00 size collets, and consequently, will handle round work from 1/16 to 3/8 inch in diameter, square work from 3/32 to 7/32 inch, and hexagonal work from 1/8 to 1/4 inch. The cross-drilling attachment also takes all standard removable drill bushings from No. 54 (0.055 inch) to 5/32-inch drill sizes. This drill-bushing attachment (not shown) is secured to the base of the "Micro-Chuk."

The new chuck has a ground angle base that permits work to be clamped in either a horizontal or a vertical position. The chuck can be clamped to the faceplate of any lathe or milling machine dividing-head for collet or indexing work. It can also be clamped to the faceplate of external and internal grinders. This chuck is especially adapted for use in the tool-room as a holding device for screw-machine second operations. It can also be used to advantage in the assembly department for holding sub-assemblies for such operations as soldering and filing, etc. 73

To obtain additional information on equipment described on this page, see lower part of page 176.



Onsrud Automatic Machine for Contour-milling Non-ferrous Channel Beams

Improved Automatic Contour-Milling Machine

The Onsrud Machine Works, Inc., 3940 Palmer St., Chicago 47, Ill., has recently brought out an improved automatic contour-milling machine which is designed to surpass the production records established by the original A80-A Onsrud machine of this type described in March, 1943, MACHINERY, page 177. The improved machine, like the original model, uses high cutting speeds and fast feeds, pattern or templet control of cutter travel, automatic cam-bar feed control, movable carriage for bringing cutter-heads to the work, and pneumatically actuated clamps for holding down the work.

Eight cutter-heads, mounted on two carriages, are used to automatically mill long non-ferrous aircraft parts, such as spar channel beams and cap strips. Each carriage has two vertical and two horizontal cutters, all eight cutters being used at one time if required by the nature of the work. In such cases, a two-station set-up is employed, the work being moved from one station to the next as fast as the cutters on each carriage finish their respective operations.

The carriage speeds, which range from 4 inches to 18 feet 6 inches per minute, are automatically controlled by a cam bar and electronic equipment to suit the amount of material removed as the cutters advance along the work. This control of the feed is obtained by means of rollers which move over a cam bar having the proper contour with relation to the work. The rollers, actuated by the cam bar, exercise rheostat control over the motors that drive the carriages; thus the carriage feeds slow down when the cuts become heavy and speed up when they become lighter. This automatic control ranges all the way from a slow feed for heavy "hogging" cuts to fast "skip" feed between cuts. A General Electric "Thy-Mo-Trol" electronic system converts alternating to direct current to obtain the wide range of stepless speed changes furnished by the direct-current motors which provide power feed for the carriages.

Cutter motor speeds range as high as 10,800 R.P.M., providing lineal cutter velocities of from 5000 to 8000 feet per minute. The eight cutter motors have a normal rating of 180 H.P. These motors are capable of withstanding 100 per cent overloads because of a special water-cooling system, thus making available a total of 360 H.P.

The over-all length of this spar milling machine is 60 feet, but the bed can be made still longer, if the work requires it, by adding sections which can be supplied in 7 1/2- or 15-foot lengths. 74

"Limitrol" Comparator Type Roll Snap Gages

The N. A. Woodworth Co., 1300 E. Nine Mile Road, Detroit 20, Mich., is placing on the market a comparator type roll snap gage of radically new design known as the "Limitrol." It is designed to

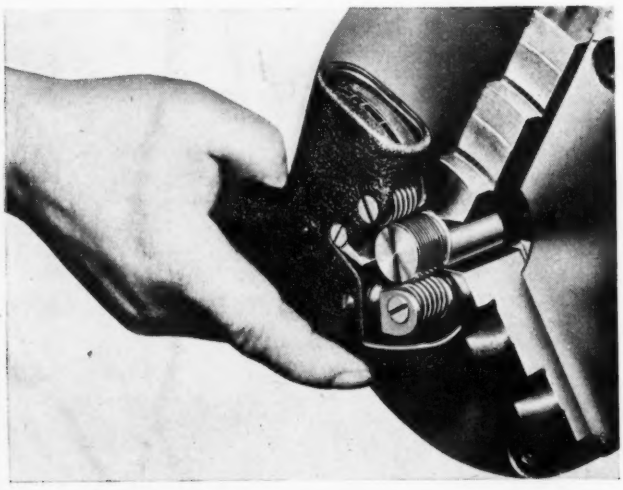


Fig. 1. "Limitrol" Comparator Type Roll Snap Gage

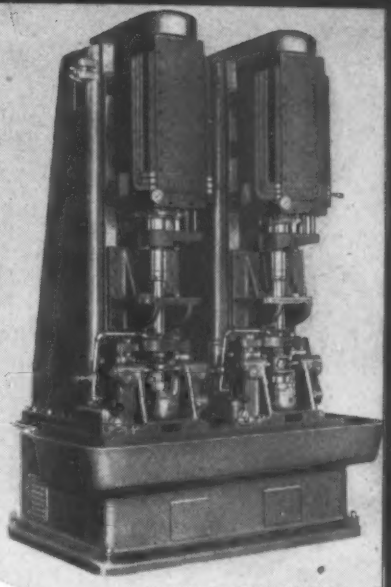
Fig. 2. "Limitrol" Gage with Base for Bench Use

To obtain additional information on equipment described on this page, see lower part of page 176.

XLO

EX-CELL-O *for* PRECISION

Here is shown an instance where the Ex-Cell-O Small Hydraulic Unit (Style 21) is used on a machine for the accurate drilling of holes in oil pump bodies.



On this Ex-Cell-O double drill press, two Style 25-A Ex-Cell-O Hydraulic Units are mounted on the columns in vertical position. This has definite advantages on certain classes of work.

Plan Now for ECONOMICAL PRODUCTION!

Production Machines equipped with Ex-Cell-O Hydraulic Units have numerous advantages

For the machine you build, or the machine we build, the use of Ex-Cell-O Hydraulic Power Units provides these features:

They are compact, for proper design.
They are self-contained, for ease in installation.
They have infinite feeds, for proper cutting.
They have gear change, for proper speeds.
They have ample power, for multiple-head operation.
They have variable stroke, for greater flexibility.

Ex-Cell-O Hydraulic Power Units are standard and produced in quantities, but in nearly every case where the unit is used it becomes a part of a special, high production type machine for a specific operation. These units are economical because, as applications change, the units can become a part of the new machine even though entire base is redesigned.

The units can be mounted on any plane—horizontally, vertically, or angularly—on a temporary or a permanent base, and they can be arranged so that it is possible to use them in connection with guide bars and multiple drill heads.

Find out today how Ex-Cell-O Special Machines and Ex-Cell-O Hydraulic Power Units can fit your program for today's and tomorrow's production.

Where high production, accuracy, and economy through multiple operations are required—consult EX-CELL-O now

EX-CELL-O CORPORATION

DETROIT 6, MICHIGAN

SPECIAL MULTIPLE WAY-TYPE PRECISION BORING MACHINES • SPECIAL MULTIPLE PRECISION DRILLING MACHINES • PRECISION THREAD GRINDING, BORING AND LAPPING MACHINES BROACHES • HYDRAULIC POWER UNITS • GRINDING SPINDLES • DRILL JIG BUSHINGS • CONTINENTAL CUTTING TOOLS • TOOL GRINDERS • DIESEL FUEL INJECTION EQUIPMENT • R. R. PINS AND BUSHINGS • PURE-PAK CONTAINER MACHINES • PRECISION AIRCRAFT AND MISCELLANEOUS PARTS

combine the desirable features of the present roll type snap gage and the dial indicator gage, and can be used either as a hand gage (Fig. 1) or as a bench gage (Fig. 2). This gage has many industrial applications, and is especially adapted for use in automotive and aircraft manufacturing plants where the gaging of external diameters up to 1 inch is necessary on high-production work.

The "Limitrol" gage can be used to perform six inspection operations on threads in one application, checking the pitch diameter, lead, taper, angle, straightness, and out-of-roundness. It is manufactured with both plain and threaded rolls, is easy to operate, and is available in both open- and closed-end models in six nominal sizes ranging from 1/4 to 7/8 inch, each size being adjustable 1/8 inch either side of the nominal size. Thus, thread diameters from No. 6 to 1 inch can be gaged. Rolls are provided in three widths, of 3/8, 5/8, and 1 inch.

For gaging parts with a tolerance of 0.004 inch or less, this gage offers 250 to 1 magnification; for parts having a tolerance greater than 0.004 inch, the magnification is 150 to 1. Rolls of different pitch are interchangeable, not more than five minutes being required to change from one set to another. To adjust or set the "Limitrol" gage, it is merely necessary to place a master between the rolls and turn an adjusting screw until the indicator arm moves under the proper limit bar. 75

Dalzen Thread Grinding Machine

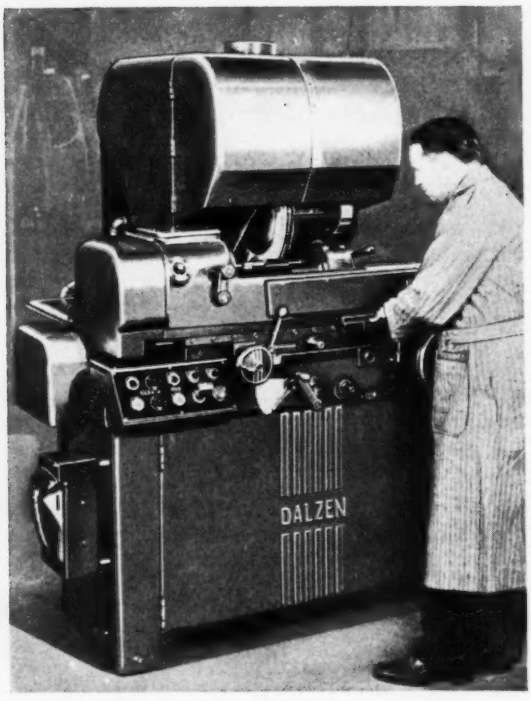
The Dalzen Tool & Mfg. Co., 12255 E. Eight Mile Road, Detroit 5, Mich., has developed a new type of thread grinder which is electronically controlled by a General Electric "Thy-Mo-Trol" drive. The new machine is designed for exceptionally high production of threaded parts, thread gages, straight and spiral fluted taps, and thread milling cutters. Its advantages include complete control of work quality, easy operation, and high uniform production rate.

The work and grinding wheel speeds are individually controlled by dial settings. Adjustment of these speeds is stepless, and the ratio is infinitely variable in both the forward and reverse directions. Motor-driven elevation of the head provides for rapid clearing of the work. The machine is specially designed to allow full vision of the work at all times. Either of two types of automatic wheel-dressing attachments can be furnished to suit requirements.

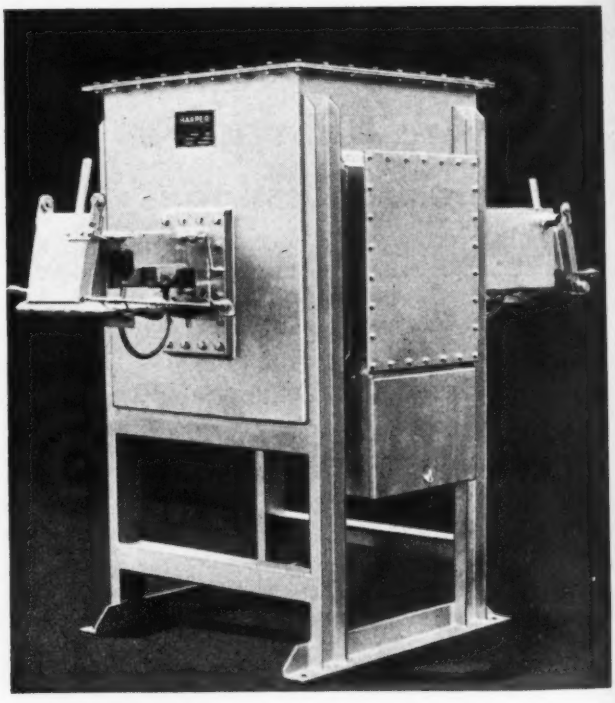
This thread grinder is available in two models. The No. 5 universal machine handles a wide variety of work up to a thread length of 9 3/4 inches in any position on a 20-inch shaft. Cutter relief may be ground up to 0.025 inch per 1/8-inch length of land. Cutters with as many as twenty-four flutes can be relieved. The No. 6 production model grinder with the back-off feature is capable of grinding threads for the full length of a 20-inch shaft. This machine requires a floor space of 63 by 52 inches. 76

Harper Electric Furnace for Sintering Powdered Metal

A line of high-temperature electric furnaces designed for sintering powdered metal at temperatures between 1800 and 2750 degrees F. has been developed by the Harper Electric Furnace Corporation, Niagara Falls, N. Y. These furnaces are equipped with a preheating



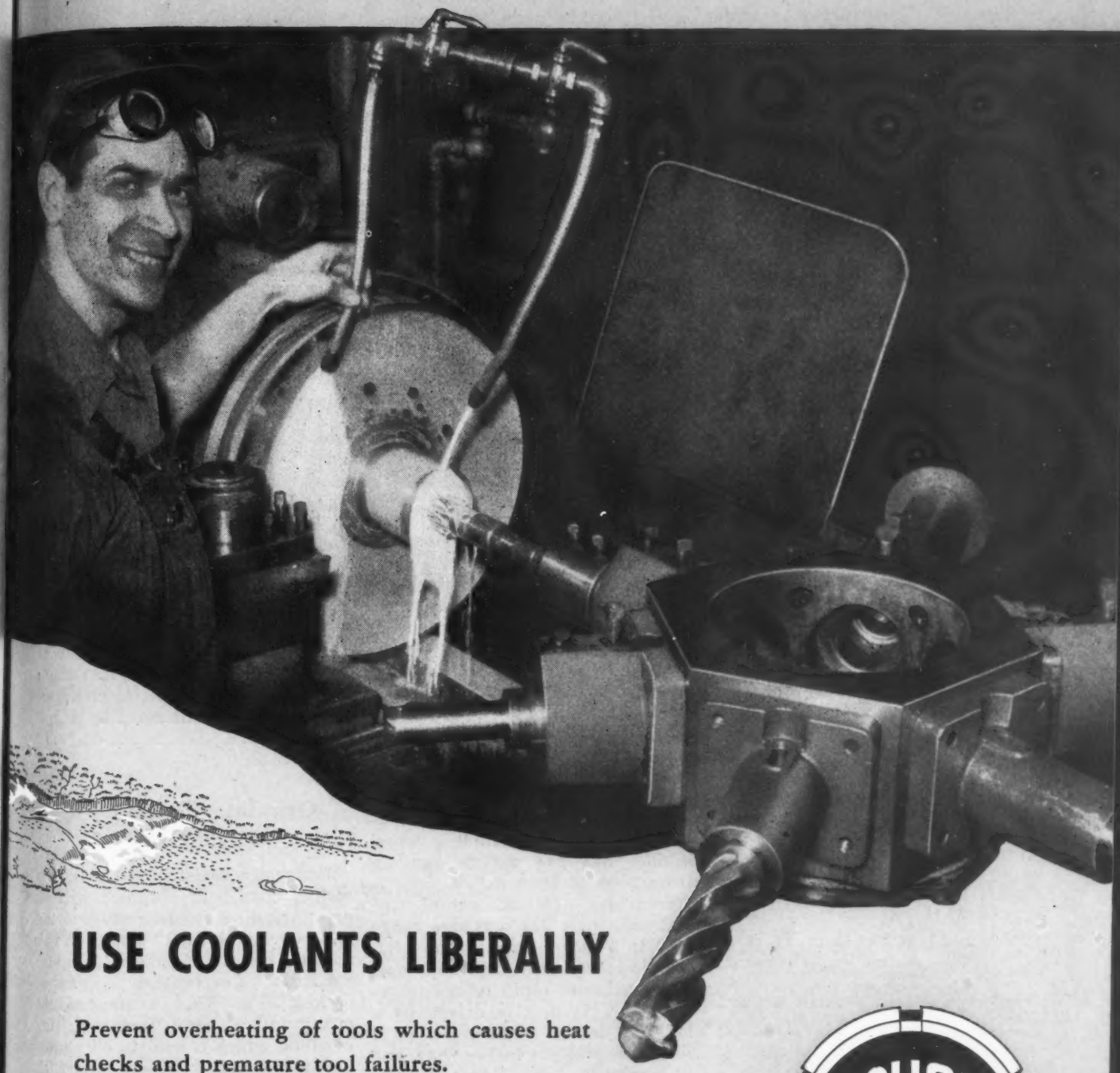
Dalzen Thread Grinder Equipped with "Thy-Mo-Trol" Drive



Harper High-temperature Electric Furnace Designed for Sintering Powdered Metal

To obtain additional information on equipment described on this page, see lower part of page 176.

KEEP COOL!



USE COOLANTS LIBERALLY

Prevent overheating of tools which causes heat checks and premature tool failures.

Don't let work get hot and difficult to handle.

Heat distortion makes accuracy difficult to maintain.

Mere trickles aren't enough. When using any coolant, flood the tool and the work for best results.

GISHOLT

Reproductions of this page on enameled paper are available for bulletin board use in your turret lathe department. Write the Gisholt Machine Company, 1209 East Washington Avenue, Madison 3, Wisconsin. Ask for the series of "Wartime Care and Operation Posters." State quantity desired.

tunnel that leads to the high-temperature chamber, and a water-jacketed cooling chamber. The entrance to the preheating tunnel and the exit from the cooling tunnel are equipped with automatic flame curtains.

Gas-tight construction permits the use of protective atmospheres, such as hydrogen, dissociated ammonia, carbon monoxide, hydrogen and nitrogen. Applications include the high-temperature cementing of tungsten-carbide dies, the sintering of powdered ferrous and non-ferrous metal parts, the heating of electronic tube parts, and a variety of similar uses. ----77

W. F. and John Barnes Automatic Grinder for Generating Optical Curves

An automatic machine designed for the rough and fine grinding of optical flats and for generating optical curves for spherical lenses of all types up to 8 inches in diameter has been brought out by the W. F. and John Barnes Co., 320 S. Water St., Rockford, Ill. This new precision machine, designated the Model No. 4, has a special hydraulically actuated automatic control, which permits a semi-skilled operator to attend one or more machines. The operator simply inserts the lens or block to be ground in the holder, presses a button to start the cycle, and removes the work at the end of the operation.

The machine is set to produce the required curvature by two simple angular adjustments of the top spindle arm and a differential screw adjustment in the spindle itself. It can be used with one all-purpose grit diamond tool-ring for both rough and fine grinding. In shops where two or more machines are used, one can be equipped with a coarse-grit (100) diamond tool-ring for quickly rough-grinding the lens to approximate size and curve, while another machine can be equipped with a fine-grit (400) diamond wheel for finish-grinding.

For grinding a single lens, the machine is equipped with a vacuum holding device in which lenses having sufficient edge thickness can be chucked and held in the work-spindle without the use of blocking pitch. With this arrangement, the lens can be inserted and removed in a few seconds, thus saving the time previously required for blocking and cleaning. The coolant tank in the base has a removable baffle tray in which the accumulated ground glass can be easily removed.

The work-spindle has a variable-speed range of from 200 to 600 R.P.M., and is driven by a 1/3-H.P. motor. The grinding wheel spindle has five speeds ranging from 2000 to 6000 R.P.M., and is driven by a 3/4-H.P. motor. The hydraulic unit has a stroke range of 3 to 5 inches, and provides hydraulic actuation of rapid traverse, slow feed, and rapid return movements. This unit is driven by a 1/3-H.P. motor. The machine is 70 inches high, 24 inches wide, and 33 inches deep. ----78

Automatic Precision Grinder Designed for Producing Optical Flats and Curves

Zagar Collet Speed Chuck

Zagar Tool, Inc., 23880 Lakeland Blvd., Cleveland 17, Ohio, has brought out a collet speed chuck designed for use in turning bar stock, facing operations, and second-operation turning. Like other Zagar collet speed chucks, it can be used on screw machines and lathes or wherever collets are employed as standard equipment. Since the collet has no movement in the axial direction while being closed, length dimensions can be held to very close limits in facing.

Collet Type Speed Chuck Made by Zagar Tool, Inc.

This chuck can be mounted on any lathe, grinder, or rotating lathe spindle, and can be opened and closed while the machine is running. Being independent of the machine spindle, it can be mounted on a faceplate, and can be adjusted by an indicator to run true regardless of any spindle run-out. It is available in 1- and 2-inch sizes. The 1-inch size takes a standard 5-C Hardinge collet, and the 2-inch size a master collet using standard W. & S. collet pads. The maximum capacity, using a special collet, is 2 5/8 inches in diameter by 1 1/2 inches deep. ----79

Grinding Coolant for High Finish

Unusually satisfactory grinding results have been obtained with a new grinding coolant known as "Microgrind No. 132" placed on the market by the Quaker Chemical Products Corporation, Conshohocken, Pa. This compound is mixed with water to form a grinding fluid which is said to eliminate pick-up, grinding checks, glazing, burning, and distortion in grinding, honing, and superfinishing operations. It is stated that high finishes free from glaze, reduction of wheel dressings to one-third the number formerly needed, faster cutting, and great increases in wheel life result from the use of this coolant when employed according to the instructions of the manufacturer. ----80

To obtain additional information on equipment described on this page, see lower part of page 176.

SIMPLIMATIC DEPARTMENT -FULLY MANNED!

GISHOLT

HERE'S a case of manpower supplanted by machine power. The four Gisholt Simplimatics in this department (each of which can out-produce two or three manually operated machines) require only two men to tend them. Production moves swiftly with no apparent effort, for all machine functions are entirely automatic. No high degree of operator skill is required.

Adaptable to a wide range of work, with multiple cutting at high speeds, Gisholt Simplimatics are the practical answer where parts are produced in large lots and where precision is essential.

Today, Gisholt Simplimatics are saving time in the production of war materials. Tomorrow, they'll be cutting costs when costs are more important.

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Look Ahead... Keep Ahead... With Gisholt Improvements in Metal Turning

IRRET LATHES • AUTOMATIC LATHES • BALANCING MACHINES • SPECIAL MACHINES

Piston-Ring Marking Machine

The Noble & Westbrook Mfg. Co., Westbrook St., East Hartford 8, Conn., has developed a new high-speed precision piston-ring marking machine, known as "No. 183 Noblewest," which consists essentially of a semi-special power-operated dial feed designed for permanently marking piston-rings with a trademark, part number, or other identification. It can also be used for marking inscriptions in other flat parts of uniform thickness. The inscription on the piston-ring is confined to a space about 1/2 inch long.

The main work-carrying dial is mounted on a vertical shaft driven by a built-in worm drive unit which runs continuously in a bath of oil. This dial has six loading stations, all of which can be used when marking small-sized rings. When a ring is too large to be accommodated by a single station, two stations are used for each ring, the feed being changed to suit this arrangement.

The marking die at the rear of the machine is mounted on a spindle which is geared to the dial so that its rotation is timed to mark each piston-ring in the same relative position. Adjustments, however, provide means for positioning the marking. A special burnishing roll is available for rolling down the burr raised by the marking die. A production of approximately 40 to 60 pieces per minute is obtained, depending upon the size of the ring and the handling facilities. Adjustable V-gages are provided so that rings of all sizes up to 6 inches in diameter can be marked in the same machine. ---------- 81

Special Machine for Milling Notches in Retainer Ring

A special milling machine has recently been developed by the Cross Co., Detroit 7, Mich., for milling notches on each side of twelve drilled holes in a retainer ring for aircraft engines. This machine has a unique automatic operating cycle designed to complete forty-eight pieces per hour at an operating efficiency of 80 per cent. The automatic feature makes it possible for inexperienced or unskilled workers to operate the machine.

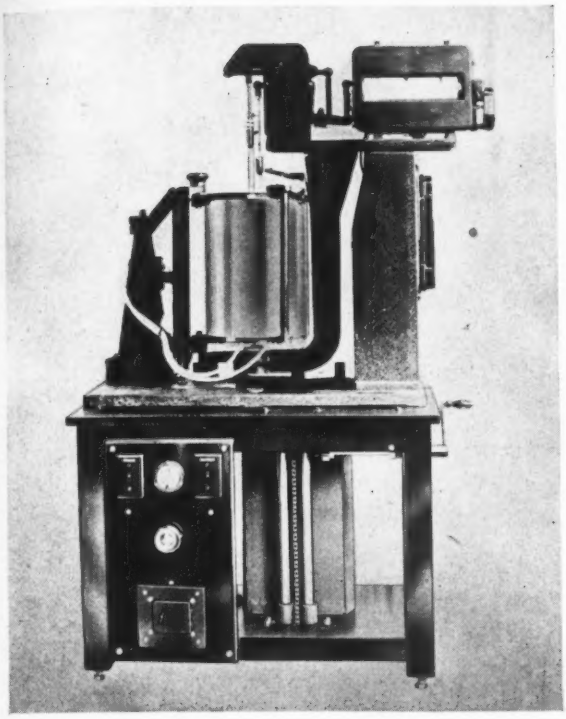
The rotary table of the machine indexes automatically as the cutters are retracted vertically upward after each cutting operation. Provision is made for locking the table positively during operation. Duplex cutter-spindles and slides are mounted in a fixed angular position on the vertical slide. Shell type motors are used in the self-contained spindle heads, the cutter-spindles serving as motor shafts. Power traverse automatically retracts the column to clear the rotary table for loading.

In operation, the work is held in a power clamping fixture and power traverse serves to move the column forward until the cutters are in the working position. The cutters are reciprocated vertically by a cam, this motion being synchronized with the automatic indexing of the work. After the holes are slotted, the cutters move to the upper vertical position, following which the column withdraws to the loading position, and the machine stops automatically. ---------- 82

Noble & Westbrook Marking Machine for Piston-rings

Cross Special Automatic Two-spindle Milling Machine

To obtain additional information on equipment described on this page, see lower part of page 176.



Bristol-Rockwell Dilatometer Designed to Record Data on Metals Tested in Split Furnace

Improved Nichols Milling Machine Equipped with Motor-driven Coolant Pump and Tank

Bristol-Rockwell Dilatometer

The Bristol Co., Waterbury 91, Conn., has recently brought out a Bristol-Rockwell dilatometer designated "Model A-134." This equipment is designed for the direct reading and recording of temperature dilation changes and temperature time changes simultaneously in ink during the heating and cooling cycles of ferrous and non-ferrous metals and other solid materials. The two records are made on a chart with rectangular coordinates to facilitate interpretation and filing. The ball-bearing multiplying mechanism exerts very light pressure on the sample, and provides smooth accurate records.

The split furnace, which is designed for temperatures up to 2500 degrees F., can be pulled away from the sample to permit quenching or cooling without disturbing the record. The furnace will take any size or shape of sample up to 1 5/8 inches in diameter by 5 inches long. It can be used to determine the critical points of carbon steel, coefficients of expansion of metals, thermal composition of steels, and the heating rates and heat saturation points. 83

Improved Nichols Milling Machine

W. H. Nichols & Sons, Waltham, Mass., have announced, through their distributor, the Nichols-Morris Corporation, 50 Church St., New York 7, N. Y., an improved milling machine of high precision construction. The general specifications of the improved machine are essentially the same as those of preceding models, and permit interchange of all tooling and attachments. The new base, with deep channels and splash guards, provides the necessary control of coolant when high-speed milling requires the work to be flooded with cutting oil.

A single bracket within easy reach of the operator carries the electrical push-button controls, adjustable depth stop for rise and fall of the spindle head, and an adjustable light. A drum switch for preselection of the spindle rotation speeds is mounted on the back of the column, together with electrical control units for overload and low-voltage protection.

The rise and fall type spindle housing permits the cutter to be presented to the work or the work to the cutter, whichever procedure is the most convenient. The table is available with a work-surface length of 21 or 30 inches and has the top surface ground to a mirror finish. The knee is machined to receive a rack and pinion transverse feed which can be substituted for the regular transverse feed-screw for precision boring, facing, recessing, and profiling operations. The machine can be furnished with a longitudinal table travel range of either 10 or 19 inches, and a transverse travel range of 7 inches. The vertical knee has a travel range of 13 1/2 inches, and the spindle a vertical movement of 4 1/2 inches. The maximum standard speed is 2400 R.P.M., but the machine can be specially furnished to provide speeds up to 5000 R.P.M. 84

Thread Pick-Up Projector for Thread Grinding

A thread pick-up projector for use in thread grinders has been placed on the market by the Acme Industrial Co., 200 N. Laflin St., Chicago 7, Ill. This unit is an optical device for pre-setting the driving dog of pre-threaded work to be ground in the threads so that when the work is placed in the

To obtain additional information on equipment described on this page, see lower part of page 176.


ENGINEERING
FOUNDRY
PATTERN MAKING
GEAR CUTTING
ENGRAVING
ENGINE DIVIDING
INSPECTION

FROM PRINT TO PRODUCT

This is a sketch of VARD INC., a precision manufacturing plant. Several departments are illustrated to show the scope of our facilities.

Here is a complete manufacturing service for precise mechanical devices, ready to assist in your present or post-war program.

A group of young, progressive engineers are the nucleus of our engineering and products development departments. Their designs move into experimental and tool making shops where highly trained machinists execute the prints on the best in toolroom lathes, jig borer, and modern mills.

In production we offer a foundry with heat treating and testing departments, supported by a complete pattern shop. Our extensive machine shops have machinery and personnel to turn out a variety of intricate hydraulic and other actuating devices, gears, clutches and navigation instruments. Inspection and assembly departments, with full hydraulic testing equipment, complement the manufacturing shops.

We have large optical and gage making departments. In temperature controlled rooms, we produce various types of thread, cylindrical and other gages, and check them to .00001 inch (one hundred thousandths of an inch). Our skilled glass workers grind and polish lenses and prisms, etc., for gun sights, observation instruments and complete optical systems—experimentally and in quantity production. We treat glass (Opticote) to reduce reflection and increase light transmission.

We engine-divide, engrave and calibrate protractors, dials, scales and calipers. We do our own painting, plating and anodiyzing.

Space limits the listing of all our activities. What are your problems? What are your needs?

Our equipment, our skilled workmen and our management experience are available to you. We invite your war or post-war experimental, development and production work.

VARD INC.

PASADENA 8, CALIFORNIA

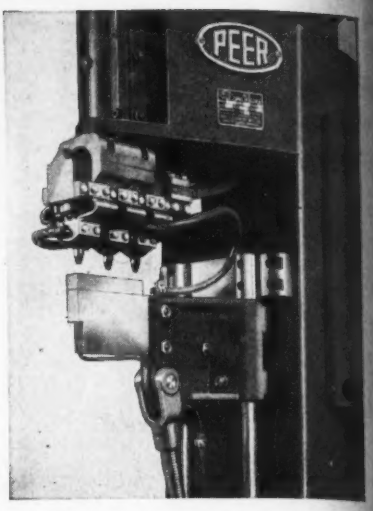
thread-grinding machine, the grinding wheel will enter the groove of the thread for a finishing cut on both sides of the thread without further adjustment. The device is specifically intended for threads that are first rough-cut, then hardened, and then finish-ground in the threads. It accommodates work up to 4 1/2 inches in diameter by 12 inches long, and is applicable to any thread-grinding machine. Inspection of thread angle and root depth is made in the same setting by means of graduations incorporated in the viewing screen. 85

Industrial Washing Machine for Metal Parts and Assemblies

The Industrial Washing Machine Corporation, New Brunswick, N. J., is manufacturing a new type of machine for cleaning metal parts and assemblies known as the "segmented cabinet" washing machine. Machines of this type are now being used for cleaning such parts as cylinders, gears, piston-rings, connecting-rods, pistons, machined castings, die-castings, rocker arms, and flexible metal conduit. The new machine has a large work-carrying turntable which rotates slowly and which is surrounded by a housing that is divided into various combinations of washing, rinsing, or slushing and drying sections.

The parts to be cleaned are placed either directly upon the turntable or on special fixtures, depending upon the nature of the work to be cleaned. As the turntable rotates, it carries the work through the sections or compartments in which the various cleaning operations are performed and returns it to the loading position. With this arrangement, loading and unloading of the work is handled by one operator. Production ranges from 2 to 10 square feet of cleaned work per minute.

The chief advantages claimed for this new type machine are as follows: Only one operator needed; small floor space required (11 by 7 feet); improved spray coverage; and adaptability for use with any of the great variety of cleaning compounds or agents now on the market. 86



Peer Spot-welder Equipped with Multiple Electrode

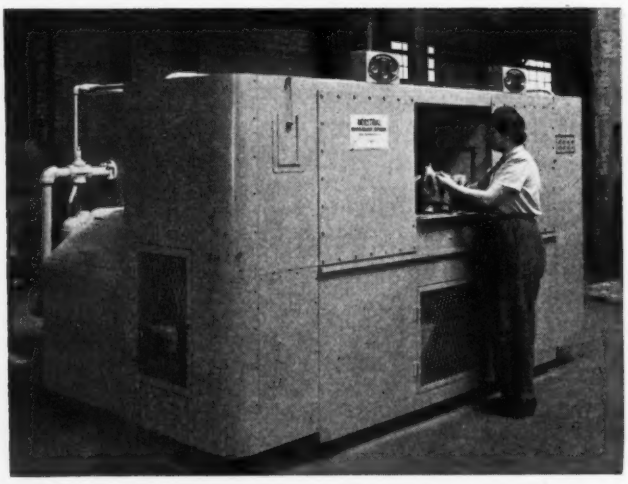
Multiple Electrode Spot-Welding Equipment

The Pier Equipment Mfg. Co., 2000 Milton St., Benton Harbor, Mich., has brought out a hydraulically equalized multiple spot-welding electrode unit or head designed to speed up assembling operations that require a number of closely grouped spot-welds. The accompanying illustration shows a Peer press type welder equipped with one of the three-point units or heads. The use of this type head made it possible to reduce to fourteen, the number of operations on a metal box requiring fifty-two spot-welds. The required spacing is easily obtained with this head, and a uniform pressure is maintained by the hydraulic equalization arrangement. 87

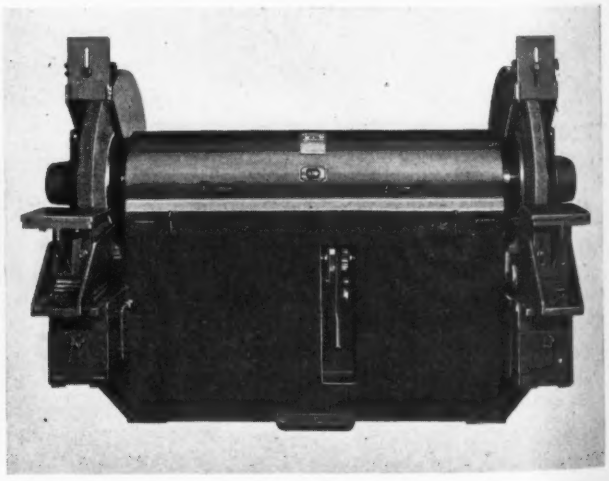
Marschke Vari-Speed Grinder

A variable-speed floor-stand grinder that can be furnished with 25- to 40-H.P. motors having momentary overload capacities of 50 to 80 H.P. has been added to the line of Marschke grinders placed on the market by the Vonnegut Moulder Corporation, 1811 Madison Ave., Indianapolis, Ind. This machine will take either 24- by 4-inch or 30- by 4-inch high-speed wheels, and is especially adapted for heavy snagging operations.

The new machine is equipped for

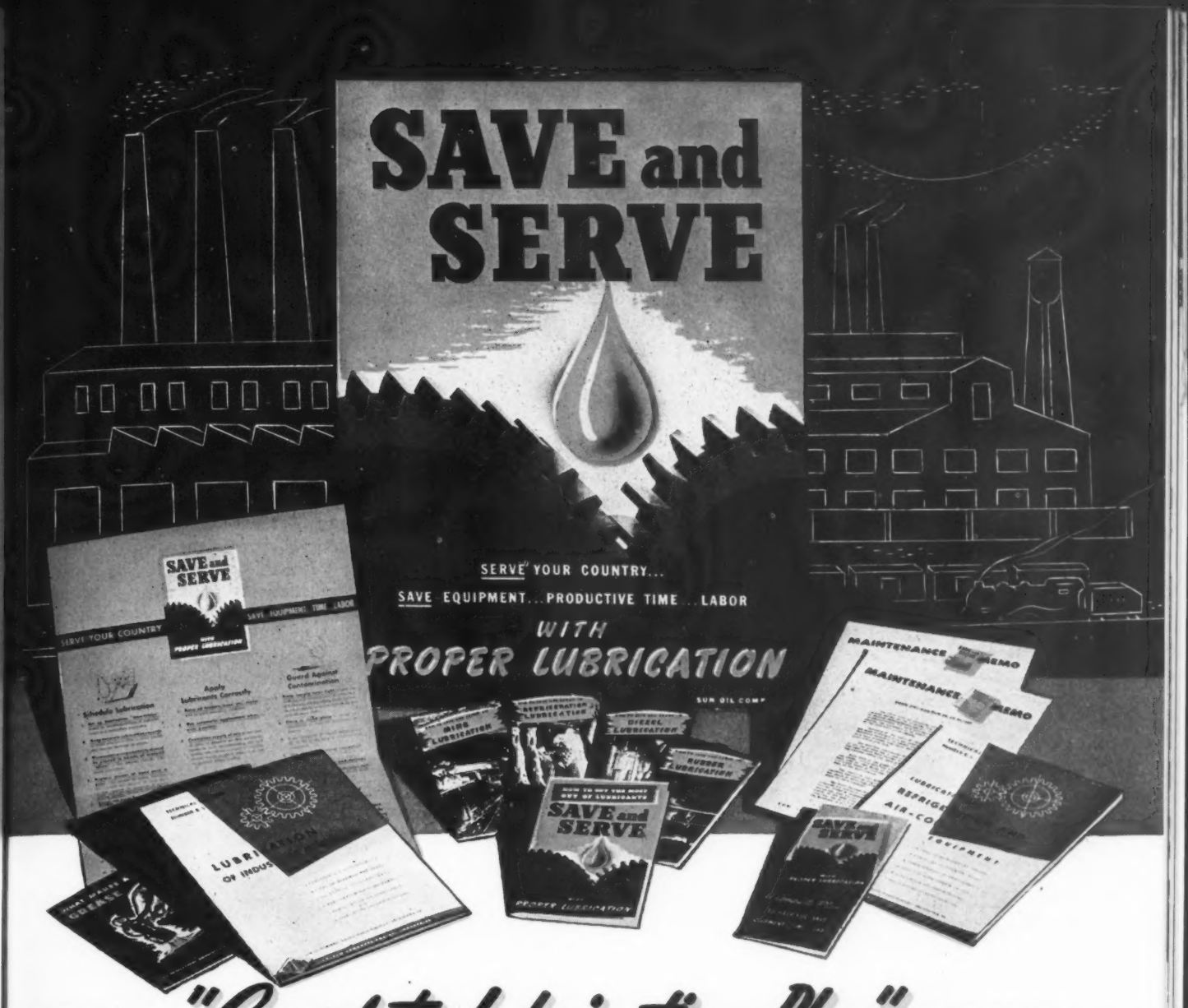


"Segmented Cabinet" Type Washing Machine Built by Industrial Washing Machine Corp.



Variable-speed Grinder Placed on the Market by Vonnegut Moulder Corporation

To obtain additional information on equipment described on this page, see lower part of page 176



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HELP YOU SAVE EQUIPMENT... PRODUCTIVE TIME... LABOR

Your equipment must last through the war . . . into the conversion period . . . and far beyond. Breakdowns and "wear-outs" must be sidetracked with efficient maintenance—proper lubrication.

That's the purpose of this SAVE and SERVE plan . . . to place in your hands the "know-how" of proper lubrication . . . to help you establish the practice of proper lubrication throughout your plant.

This plan is practical and easy to use. It has been prepared by Sun Lubrication Engineers to give you the benefit of their broad experience. The SAVE and SERVE Plan includes plant poster, wall chart, lubrication manual, technical bulletins, performance folders and maintenance memos. It will aid every man in your plant who is concerned with the operation of machinery to make it run better and last longer.

Put Sun's SAVE and SERVE Plan to work in your plant! It's yours for the asking, to help you save vital equipment . . . productive time . . . and labor. Write today for the folder which gives you the complete details . . . tells you how to get all of the material.

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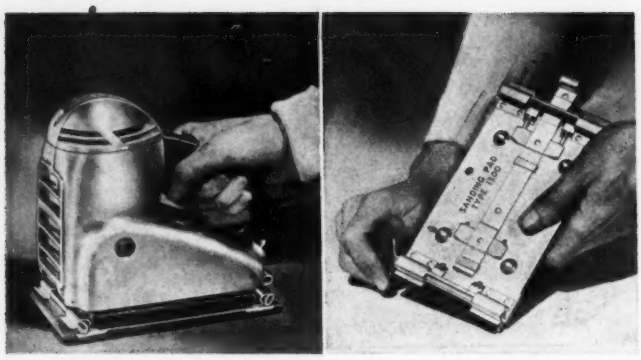
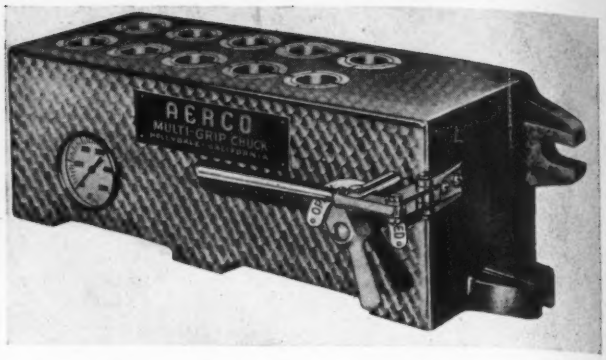


(Left) Sterling Sander. (Right) Method of Using Key to Lock Abrasive Strip to Sanding Pad



Milling Chuck with Two Rows of Work-holding Collets Made by the Aerco Corporation

automatic regulation of the variable-speed control to assure the correct rim speed for the grinding wheel. Accurately fitted flanges and heavy steel wheel guards are provided for safety. The 9- by 13 1/2-inch work-rest top plates have a vertical adjustment of 4 inches. The distance between the wheels is 64 inches. The machine occupies a floor space of 84 by 60 inches, and weighs 4000 pounds.—88

Sterling Sander with Detachable Sanding Pad

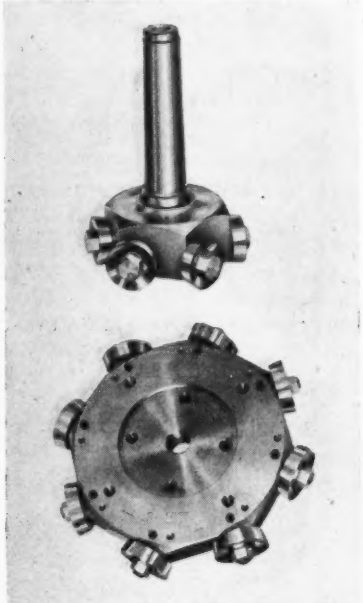
An outstanding feature of the new "Sterling 1000" portable electric sander, made by the Sterling Tool Products Co., 358 E. Ohio St., Chicago 11, Ill., is a flexible sanding pad which can be quickly detached by simply pulling out a latch. Several pads loaded with abrasives can be kept near the work for quick changing. When different grades of abrasives are used on a job, additional pads loaded with the required coarse- and fine-grit abrasives can be furnished, so that no time will be lost in changing from one grit to another.

The Sterling sander is especially designed to cover the entire range from coarse sanding to lapping and finishing. It provides fast uniform cutting on wood, metal, and plastics. The sanding pad is flexible, and will conform to convex or concave surfaces of moderate curvatures. Special pads for unusual contour sanding or rubbing are also available. The tumbler-action locks on the sanding pad can be easily operated by a key, as shown in the view to the right in the illustration. An important feature of this sander is the non-vibrating action of the body and handle, which permits the operator to use it constantly without tiring, even when the sanding pad is operating at 4500 oscillations per minute.—89

Aerco Multi-Grip Chuck

A new hydraulic multi-grip milling machine chuck having two rows of five collets each has recently been placed on the market by the Aerco Corporation, Hollydale, Calif. The ten parts held in the two rows of collets can be milled simultaneously. A few strokes of the hydraulic hand-pump supply the necessary pressure for closing all collets simultaneously and for building up a pressure as high as 2500 pounds per square inch.

This new chuck is made in two compact self-contained models. Model 10-B measures only 14 1/4 by 4 1/2 by 4 1/2 inches and has a collet capacity of 1/8 to 1/2 inch, while Model 10-E measures 21 by 6 3/4 by 6 3/4 inches and has a collet capacity of 1/2 to 1 1/4 inches. Collets are available for round, square, and hexagon work.—90



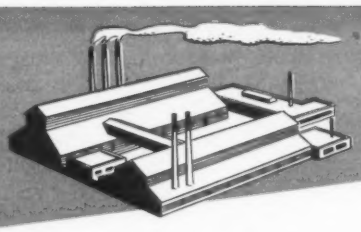
Shearcut Milling Cutters Designed to Cut with True Shearing Action

Shearcut Milling Cutters

A new line of milling cutters having bits with circular edges that remove metal by a true shearing action has been brought out by the Shearcut Tool Co., 362 S. Maple Drive, Beverly Hills, Calif. These cutters, known as Shearcut "Lifetime," are said to leave a mirror-like surface on practically any metal. When a cutting edge of one of the cutters is dull, it is unnecessary to remove the tool from the machine, as simple rotation of the cutter a fraction of an inch will present a sharp cutting edge to the work. This adjustment requires less than a minute and does not disturb the set-up.

Each shear cutter, depending on the diameter, has ten to thirty cutting edges immediately available. The greater endurance inherent in the slicing action and the tendency of the cutters to resharpen themselves automatically by the sliding of the curled chips over the inside edge greatly increases the life of these cutters, as compared with plain straight milling edge cutters, before regrinding is necessary. The regrinding operation can also be performed easily in less than fifteen minutes, and requires no special skill. The cutters are furnished with No. 40 National Standard shanks and No. 9 Brown & Sharpe taper shanks.—91

To obtain additional information on equipment described on this page, see lower part of page 176.



AMERICAN INDUSTRY SAVES

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KENNAMETAL PRODUCTS

CUTTING TOOLS

Kennametal-tipped single-point tools are used in America's leading machine shops for turning, facing, and boring steel up to 550 Brinell hardness, cast iron, and the softer metals.

MILLING CUTTERS

Kennametal-tipped cutters have revolutionized milling practices by making possible the milling of all metals, including the toughest steels, at almost incredible speed.

WEAR RESISTING PARTS

Kennametal inserts are used to prolong precision machine performance by protecting the "wear-areas" against effects of friction, corrosion and erosion.

The carefully recorded experience of one of our customers for the year 1942 indicated that actual savings resulting from the use of Kennametal-tipped machining tools totaled $50,000. Projected to a national basis for the same year, American Industry saved approximately $750,000,000 through the use of Kennametal. In 1943, the widely extended application of Kennametal increased these savings correspondingly.

These are dollars-and-cents figures—figures in which industry is normally interested. But as American citizens, we are today even more interested in how the savings will help win the war—man-hours saved and production gained are the vitally important factors. Every faster cutting operation in your shop means faster cutting of the deep, straight paths of destruction that lead to Berlin and Tokyo. Shortening the job means shortening the war. Shortening the war means saving lives.

You can shorten machining time, and cut costs, by using Kennametal-tipped tools. Kennametal, a cemented carbide composition, contains a unique intermetallic compound (tungsten-titanium-carbide) that is unsurpassed, except for the diamond, in hardness. Our district field engineer can tell you how to use it for maximum metal-cutting results. Kennametal Catalog 43-C contains useful information on tool design, use, and maintenance. Write for it.

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SUPERIOR CEMENTED CARBIDES

Torsiometer Made by the Sheffield Corporation

Torsion-Measuring Instruments for Small Spiral Springs

A torsiometer designed for the precision measuring of the torsion of small spiral springs is now being produced by the Sheffield Corporation, Dayton 1, Ohio, as a result of collaboration with the Gruen Watch Co. and the Manross Division of the Associated Spring Corporation. A direct reading of the torsion measurement of the spring under test can be made in millimeter-grams on a graduated scale of the torsiometer. This permits the identifying and classifying of springs with respect to torsion before they are assembled in instruments.

The torsiometer will accommodate springs up to 2 7/8 inches in diameter with a maximum torsion measurement of 49.5 millimeter-grams. This capacity is sufficient to cover practically the complete range of springs used in most instruments. The inner end of the spiral spring to be checked is attached to the center post, and the outer end is grasped by the suspended tweezers. The outer mark is set at 120 on the scale, which represents the zero point. The dial is then turned one complete revolution. The point on the scale at which the indicator then rests indicates the torsion classification of the spring. ——92

DoAll Current Rectifier and Magnetic Chuck

Continental Machines, Inc., 1312 S. Washington Ave., Minneapolis 4, Minn., have announced two additions to the DoAll line—an electromagnetic chuck and an electric current rectifier known as "Selectron." The Selectron is designed to serve both as a current rectifier and a demagnetizing unit for operating the chuck. This combination of magnetic chuck and rectifier is especially adapted for holding difficult grinding work.

With this equipment, the amount of magnetic pull exerted by the chuck for holding the work to be ground can be accurately controlled by the operator. The electronic power furnished by the Selectron to control the magnetic pull is also used in demagnetizing the chuck when the work is to be removed. The Selectron is available for operation on an alternating-current input of 120 or 220 volts, which furnishes an electronic tube full-wave rectified 220-volt direct-current output of 175 watts.

The entire chuck unit is made of cast steel of high permeability to provide the maximum work-holding power with the minimum current consumption. The working surface of the chuck is ground to a mirror finish, and the sides and ends are made square and parallel to facilitate aligning the work when using adjustable stop-plates on the end and side. The chuck is available in two sizes—6 by 18 inches, 125 watts; and 8 by 24 inches, 175 watts. ——93

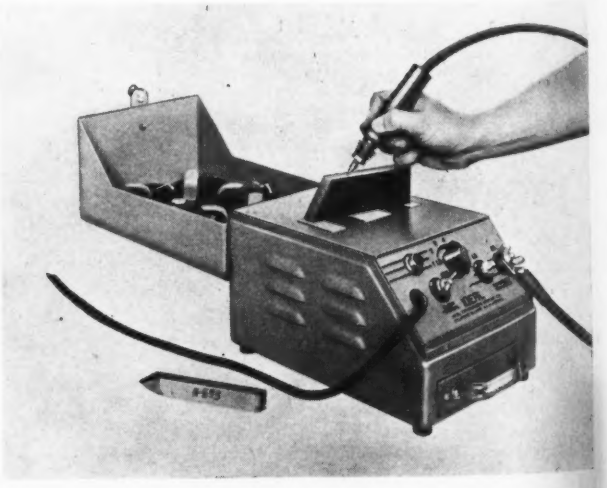
Combination Etcher and Demagnetizer

The Ideal Commutator Dresser Co., 1011 Park Ave., Sycamore, Ill., has developed a new unit that can be used either as an etcher or a demagnetizer. It is enclosed in a case with a removable hinged cover and is ready for use either for etching or demagnetizing when plugged into the electric circuit. Small tools and parts to be etched are simply placed on the workplate, the switch turned, and the etching started. A ground clamp is provided for use in etching parts that are too large for the workplate.

There are fourteen heat adjustments ranging from 90 to 600 watts for the low range and from 300 to 1350 watts for the high range, which are obtained by the "Hi-Lo" tap and seven-point switch. This gives a wide range for marking all irons, steels, and their alloys, and for handling work ranging in size from delicate parts up to large smooth castings.

To demagnetize a part, the switch

DoAll Selectron and Magnetic Chuck

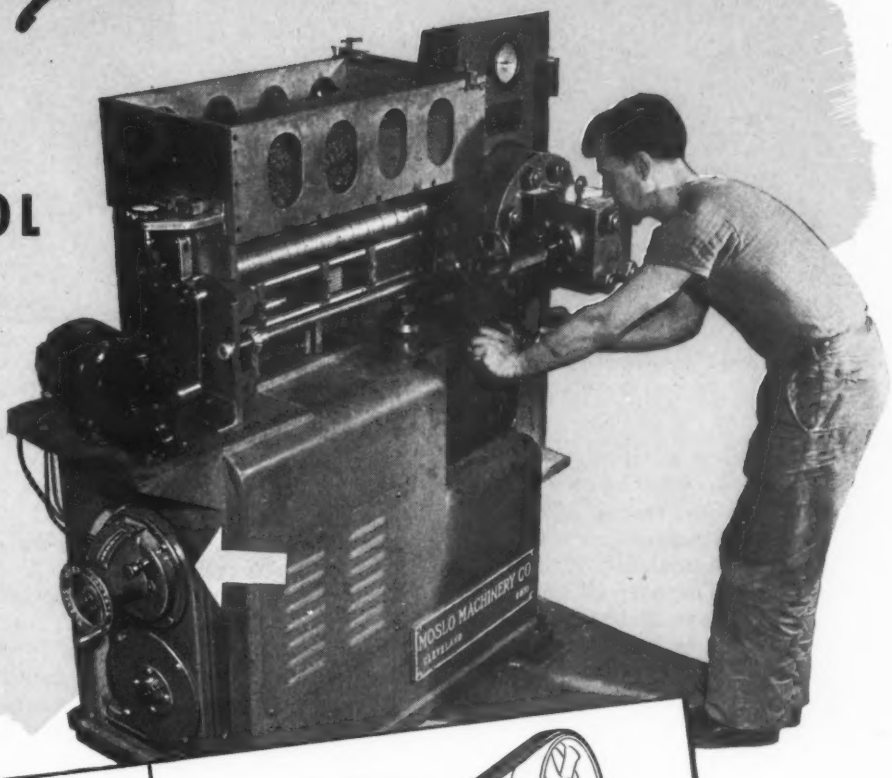


Ideal Combination Etcher and Demagnetizer

To obtain additional information on equipment described on this page, see lower part of page 176.

Industry's Preferred

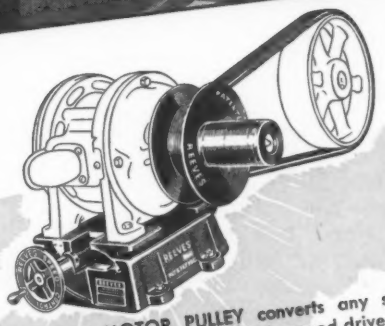
METHOD OF SPEED CONTROL



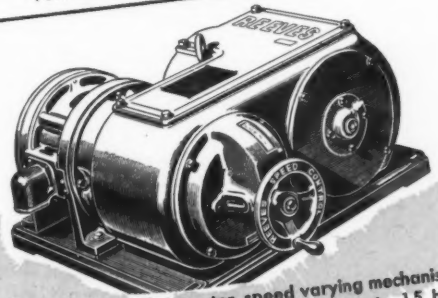
The definite preference of plant superintendents, machine shop foremen, expediters and operators for REEVES Variable Speed Control is not hard to understand. No other speed control is so flexible, so infinitely variable, so positive and dependable in operation. No other offers so many types and sizes of units to meet every installation requirement. Get full information from Catalog offered below.

REEVES PULLEY COMPANY, COLUMBUS, IND.

VARIABLE SPEED TRANSMISSION for infinite speed adjustability over wide range of speed ratios, 2:1 through 16:1 and in sizes to 87 horse power.



VARI-SPEED MOTOR PULLEY converts any standard constant speed motor to a variable speed drive. Sizes to 15 h.p. Speed variation within 4:1 ratio.

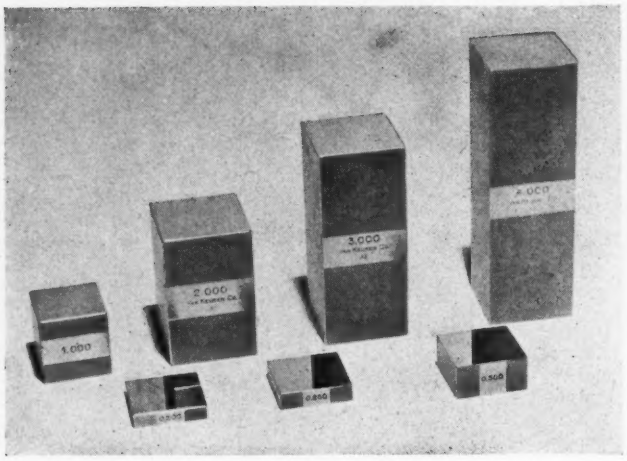


MOTODRIVE combines motor, speed varying mechanism, reduction gears in one compact unit. Sizes to 15 h.p. Speed variation 2:1 through 6:1.

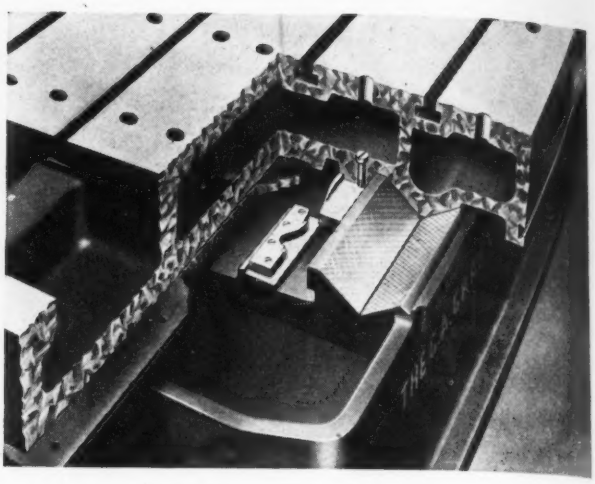
★ **NEW CATALOG**

This authoritative 128-page book on variable speed control describes the complete REEVES line of speed control equipment. Ask for Catalog-Manual M. ★

REEVES *Accurate Variable* Speed Control



Solid Square Master Gage-blocks Made by the Van Keuren Co.



Gray Safety Stop Designed to Prevent Over-running of Planer Tables

is turned on to either the No. 1 or 2 position, after which the procedure is the same as with any ordinary demagnetizer. The maximum demagnetizing rating is 5.5 amperes. The over-all pole area is 13 1/2 square inches. The combination unit is 8 1/4 by 11 1/2 by 8 5/8 inches. 94

Vard Snap-Gage Stand

Vard Inc., 2961 E. Colorado Blvd., Pasadena 8, Calif., has brought out a stand for supporting roll thread snap gages in a convenient working position. It is claimed that this stand will increase inspection output, relieve operator fatigue, and enable inspection operations to be performed more accurately. The gage is firmly retained in the stand by means of an Allen head socket screw, an additional bearing plate being provided for the larger size gages, which engages the wide pads on the Vard snap-gage frame. Use of this stand permits the inspector to employ both hands for holding the work to be checked, thereby assuring steady, accurate alignment of the threads between the rolls.

These bench inspection stands are made in two types—Model GSC, which is 4 1/2 inches long, 3 inches wide, 3 1/4 inches high, and weighs 2 pounds; and Model GSA, which is 6 5/8 inches long, 3 1/2 inches wide, 3 1/2 inches high, and weighs 5 pounds. This model accommodates Vard Johnsons roll snap gages in the sizes required for checking threaded parts up to 13 inches in diameter. 95

Solid Square Master Gage-Blocks

The Van Keuren Co., 176 Waltham St., Watertown, Mass., has recently developed an improved set of precision gage-blocks. These "Solid Square Master Blocks" are of a new design and are the result of years of experience in the manufacture of precision gage-blocks.

Gage-blocks up to 1 inch in length are 1 inch square. The 2-, 3-, and 4-inch blocks are 1 1/4 inches square. These blocks, therefore, have two and one-fourth times the wearing surface of conventional rectangular gage-blocks. The material used in these blocks is very hard and dense, difficult to lap, and has a hardness of 68 Rockwell C. These master blocks are furnished in sets of 85, 81, and 41 blocks or as individual gages. 96

Vard Snap-gage Stands

Gray Safety Stop for Planer Tables

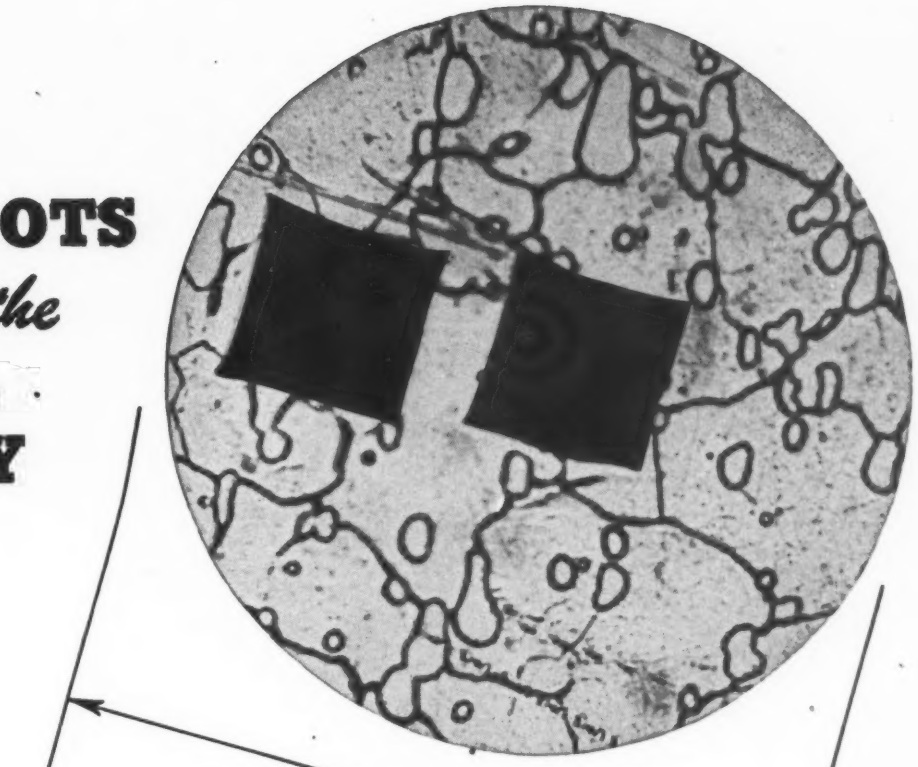
Planers built by the G. A. Gray Co., 3611 Woodburn Ave., Cincinnati 7, Ohio, are now being equipped with a device for stopping the table in the event that the table rack accidentally runs off the bull gear. The need for such a braking device in case the driving motor fails to stop and reverse the table has been apparent for some time, but has become more acute since the recent adoption of higher speeds, which may cause a runaway table to travel four times as far, before coming to rest, as when operated at the speeds formerly used. In the average shop, it is not feasible to allow sufficient clearance for such over-travel at each end of the planer, and, consequently a runaway table becomes dangerous.

The Gray safety stop consists of cutting tools bolted to each end of the bed in such positions as to engage stop-blocks bolted to the under side of the table, as shown in the illustration. The table is brought to rest by the resistance offered the tools when they cut into the metal stop-block. The tools do not engage the block unless the rack at one end of the table runs completely off the bull gear.

Tests made on high-speed planers have shown that the tables are brought to rest by the stops in distances varying from a few inches for the smaller planers to not more than a foot for the largest machines. A replacement block can easily be bolted in place without removing the table from the machine bed. 97

To obtain additional information on equipment described on this page, see lower part of page 176.

MICRO DOTS *now tell the* REAL STORY



of Michigan Gear Cutting

TOOL STEEL

Checking the correctness of heat-treat of gear cutting tool steels by conventional methods alone has now been obsoleted by Michigan Tool Company. In the metallurgical laboratory at "Gear Production Headquarters" you will find such steels checked by new MICRO-hardness testers—under a 1000 power microscope.

This tester gives the individual hardness of every portion of the basic grain structure, where conventional methods can give only the *average* hardness of the grain particles covered. Ten of those dots, above, would not stretch across the diameter of the equivalent Rockwell "mark".

Once such a device was considered a scientific research instrument. Today, Michigan Tool Company employs it in routine production control to assure that the cutting tools it produces for the war effort will be the finest it is possible to make.

ORIGINATORS of GEAR SHAVING

MICHIGAN TOOL COMPANY

7171 E. McNICHOLS ROAD • DETROIT 12, U. S. A.

BUY U.S. BONDS STAMPS

Universal Pneumatic Jaw for Hufford Bending Machine

Universal Pneumatic Jaw for Hufford Hydraulic Bending Machine

A positive-opening, positive-closing pneumatic jaw unit for holding bars of T-shape, U-shape, L-shape, or practically any other shape, has been brought out by the Hufford Machine Works, Inc., 315 Diamond St., Redondo Beach, Calif. This jaw unit is intended for holding the work during stretch-forming operations on the Hufford bending and beveling machine. Operation of the new jaw is fast, simple, and positive. The hardened steel inserts are easy to construct and are quickly interchangeable for holding bars of various shapes. The main housing remains on the tension cylinder piston-rod, the only operation required for changing inserts being the removal of the collar by unscrewing it from the housing.

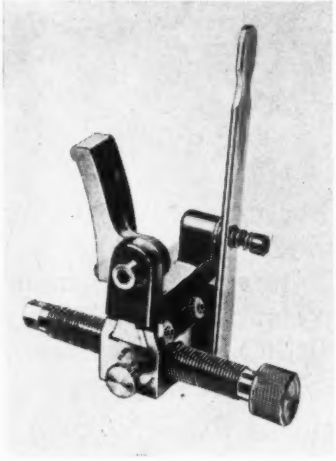
Inserts can be made for holding work of any size that can be fitted into a circle 4 inches in diameter. The jaw consists essentially of a double-acting integral air valve, piston assembly, housing, collar, and the hardened steel jaw inserts. The integral air valve eliminates the need for separate control valves and receives air from the regular plant supply. ----98

Airco Coated Aluminum-Bronze Electrode

The Air Reduction Sales Co., 60 E. 42nd St., New York 17, N. Y., has announced that a new coated aluminum-bronze electrode, designated "Airco No. 100," is now available through the offices of the Air Reduction Sales Co. and its distributors. This shielded-arc, coated, high-tensile bronze electrode can be used as a filler rod in carbon arc welding, and will produce welding deposits of great strength and high ductility, combined with resistance to corrosion. It is adapted for welding most bronzes, malleable and cast iron, and steel. The welding of dissimilar metals, such as cast iron to brass or steel to malleable iron, and the joining of any two metals that are weldable with aluminum bronze, can also be accomplished with this electrode. The new electrodes are regularly made in sizes from 1/8 to 3/16 inch in diameter by 14 inches long, and in 1/4 inch diameter by 18 inches long. ----99

Florian "Jiffy" Wheel-Dresser

The American Standard Co., Southington, Conn., has announced to the trade a new grinding wheel



Florian "Jiffy" Wheel-dresser for Surface Grinders

dresser designed for mounting on tool-room surface grinders, which is known as the Florian "Jiffy." This new dresser becomes an integral part of the grinder on which it is mounted, and is always ready for wheel dressing, regardless of the position of the wheel relative to the table. In using this dresser attachment, it is not necessary to disturb the work set-up. ----100

Taper Cutter for Milling Buttress Threads

A new taper type thread milling cutter designed to produce accurate straight-sided or buttress threads at high production rates has been brought out by the Detroit Tap & Tool Co., 8432 Butler Ave., Detroit 11, Mich. This new cutter, shown in Fig. 1, is being used successfully in several plants. The specific application for which it was originally developed consisted of cutting buttress or straight-sided threads in an aluminum forging to receive threaded valve-seat inserts.

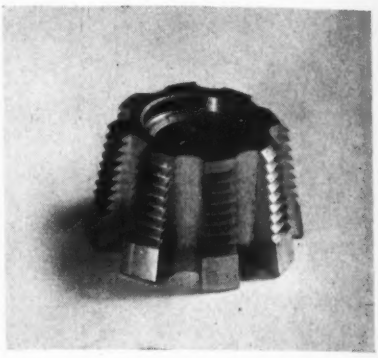


Fig. 1. Taper Cutter for Milling Buttress Threads

The cutter design and its application are shown diagrammatically in Fig. 2. The cutter teeth engage the work on a line parallel to the axis of the threads being formed, but they rotate in a plane inclined to the straight side of the thread. Inclination of the cutter at an angle equal to the taper of the cutter provides clearance for the straight-side cutting face and results in even distribution of the cutting load over a full length of the tooth

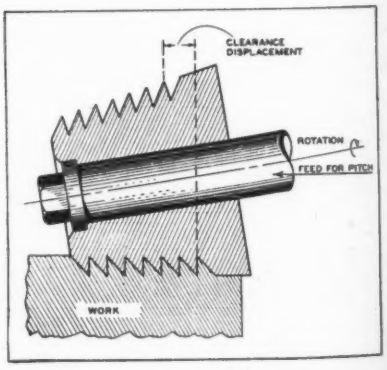
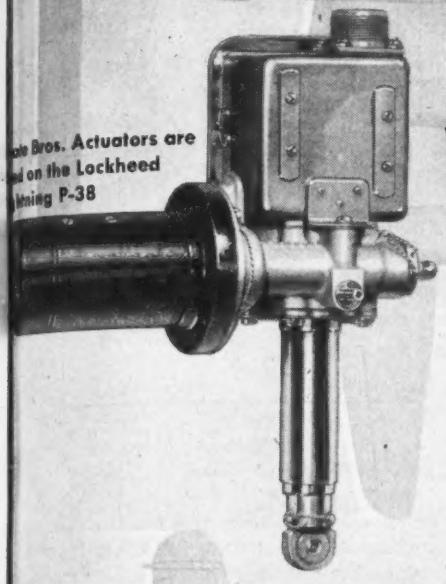


Fig. 2. Diagram Illustrating Design and Application of Cutter Shown in Fig. 1

To obtain additional information on equipment described on this page, see lower part of page 176.

PACKAGES OF POWER

FOOTE BROS. ACTUATORS DO THE HEAVY MECHANICAL JOBS



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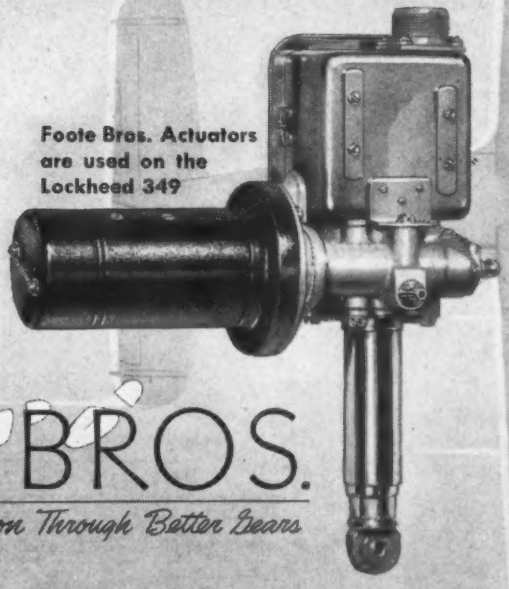
Foote Bros. Actuators are used on the Lockheed Constellation C-69



Foote Bros. Actuators are used on the Lockheed 349

As airplanes have increased in complexity, the job of the pilot has become more and more difficult. To free him of some of the heavy mechanical jobs, actuators have been developed which are, in effect, packages of power that perform many such jobs as opening and closing ventilators, operating wing flaps, retracting under-carriages and setting stabilizers.

These actuators are compact motor-driven units requiring gears of extreme precision. Their proved practicability on airplanes now flying points the way to greater use on planes now on drafting boards.

Because of the vast technical experience and manufacturing "know hows" acquired in producing high precision gears, gear units and actuators for the aircraft industry, Foote Bros. has developed new manufacturing methods that point the way to better "power transmission through better gears" for peacetime industry.

FOOTE BROS. GEAR AND MACHINE CORPORATION
5225 South Western Boulevard • Chicago 9, Illinois

FOOTE BROS.

Better Power Transmission Through Better Gears

face without any tearing action. The plain milling section of the cutter removes the incomplete thread at the outer edge.....101

Grinding Wheel for Synthetic Rubber Products

A grinding wheel for finishing molded synthetic rubber products, developed to cut fast, clean, and cool without pulling or crowding the softest rubber compounds, has been brought out by the Atlantic Abrasive Corporation, 518 Pearl St., South Braintree, Mass. This new abrasive grinding wheel, known as "Atlantic B-C," is said to remain cool when used on all types of rubber and to completely eliminate the fire hazard in grinding or finishing operations. It is available in a variety of shapes and sizes.....102

Hilliard Cutting Oil Recovery Unit

A completely assembled cutting oil recovery unit for extracting oil from metal chips, filtering, and sterilizing it is being manufactured by the Hilliard Corporation, 400 W. Fourth St., Elmira, N. Y. In operating this oil recovery unit, shown in Fig. 1, the chips are placed in the chip wringer, from which the extracted oil flows into an accumulator tank and then through removable baffle screens, as indicated in Fig. 2. A motor-driven pump then picks up the oil and forces it through the Hilco Hyflow oil filter, which is equipped with electric heaters and contains the filtering material. Here the oil is filtered, sterilized, and passed on to a clean oil tank. In some plants, as much as 85 per cent of the oil previously discarded or lost is now being saved by this unit. 103

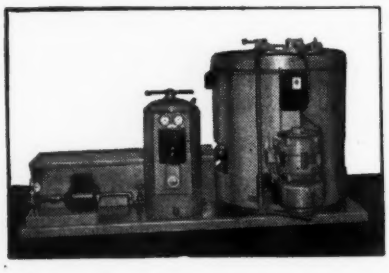


Fig. 1. Hilliard Unit for Extracting Cutting Oil from Chips

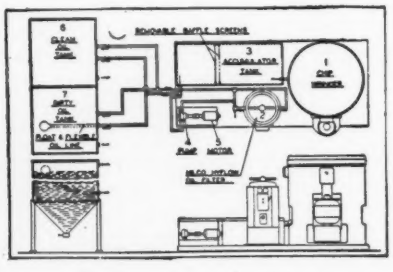


Fig. 2. Diagram of Oil Recovery Assembly Shown in Fig. 1

Carbide-Tipped Tools

The New England Carbide Tool Co., Inc., 60 Brookline St., Cambridge 39, Mass., is placing on the market a new line of carbide-tipped cutting tools in six shank and tip styles. The tips of these tools are finish-ground on diamond wheels, so that all exposed surfaces have a mirror finish. The tool shanks have a black rustproof finish, and the name and tool style are marked in white on the side of the tool.

Carbide-tipped Tool Made by the New England Carbide Tool Co.

These tools are supplied with either of two grades of carbide tips. The "U" grade will cut all materials, except steel, such as aluminum, cast iron, bronze, nonmetallic substances, etc. This grade is identified by a red tip on the tool shank. The "S" grade is supplied for cutting steels, and is identified by a blue tip on the shank. 104

Oil-Rite Constant-Level Lubricator

An improved constant-level lubricator has just been brought out by the Oil-Rite Corporation, 3490 S. 13th St., Milwaukee 7, Wis. This new Type J lubricator is adapted for use on electric motors, pillow blocks, pumps, air-conditioning equipment, gear-boxes, or wherever bearings or other machinery parts must be provided with an ample supply of lubricant. A new type of plastic cement that is not affected by oil, water, heat, or acid seals the lubricator to its collar.

Improved Oil-Rite Lubricator

When the reservoir is filled, only enough oil is released to fill the bearing oil well to a line on the lubricator base. When the oil level falls, air is admitted into the reservoir through a vent, thus automatically releasing just enough oil to refill the well to its original level. These lubricators are available in four sizes with capacities of 2, 4, 8 and 16 ounces.....105

* * *

Machine Tool Production

According to figures published by the Tools Division of the War Production Board, machine tool shipments in January, the last month for which complete figures are available, totaled $57,000,000; this is at an annual rate of approximately $685,000,000. The total net orders booked in January amounted to $27,800,000, "net orders" meaning all new orders placed less cancellations. This amount of net new orders is at an annual rate of approximately $335,000,000.

It is of interest to note that the net new orders received in January slightly exceeded those placed in December. The backlog of unfilled orders for machine tools at the end of January was $182,330,000, which is equivalent to slightly more than three months' business at the rate of the January shipments.

To obtain additional information on equipment described on this page, see lower part of page 176.

CHICAGO

MOUNTED WHEELS AND SMALL GRINDING WHEELS

A complete range of styles, grains and sizes up to 3" in diameter to give you a perfect finish on every job.

PROMPT DELIVERY

Specialization—with full W P B approval—on sizes 3" in diameter and under, means no waiting for Chicago Grinding or Mounted Wheels. Let us take care of your present and post-war requirements.

FREE ENGINEERING ANALYSIS

If you have a grinding job that presents a problem because of the nature of material, tricky shape or other reason, tell us about it. Our experts will go into a huddle and give you the benefit of our long experience making millions of custom built wheels for every conceivable operation.

YES, YOU CAN FINISH IT BETTER WITH A CHICAGO WHEEL

Half a Century of Specialization has Established our Reputation as the Small Wheel People of the Abrasive Industry.

ARMY E NAVY MOUNTED WHEELS

...progress to a new world is better tools of war, so the ... a perfect finish is better grinding wheels.

...day's standards of finishes are far and beyond those of yesterday. To acquire them without sacrifice of production time is a goal which everyone seeks.

Finish must now be measured in micro inches. That's where the new Chicago FV BOND Wheels excel. They give a precision smoothness so intensified that it passes any surface analyzer test, in many cases eliminating hand lapping and auxiliary finishing operations.

HERE'S WHAT MAKES CHICAGO WHEELS CLICK—

A—Sensational new FV BOND. Result of research and experiment on hundreds of aircraft jobs.

B—No sacrifice of cutting time or wheel life.

FV BOND is available in all types of Chicago Mounted and Small Grinding Wheels—in all abrasives, grain and grade combinations.

TEST WHEEL FREE — To prove their superiority in your own shop, send for a Chicago Wheel made with FV BOND. Give us details of the job, material you want to finish and we'll do the rest.

Write for Catalog and Interesting Engineering Survey Form

CHICAGO WHEEL & MFG. CO.

1101 West Monroe Street Dept. MR Chicago 7, Ill.

Pneumatic Contour Control Simplifies Precision Machining of Formed Work

A PNEUMATIC control system for machine tools which provides means for automatically machining work to the form or contour determined by a thin metal templet within exceptionally close limits of accuracy has been developed by the Bailey Meter Co., Cleveland, Ohio. This new system employs the same principle incorporated in the precision air measuring gage. It has been used on a lathe to successfully turn, bore, and face work automatically to the exact contour of the guide templet, holding duplicate work to size within 0.0002 inch.

The surface smoothness obtained is determined by factors other than the control system itself, such as the condition of the tool or cutter and the accuracy of the templet. A surface smoothness of 60 micro (millionths) inches as measured by the Brush surface analyzer is said to have been obtained when the tool and the templet have been properly ground and honed.

Contour work with slight or steep tapers, round corners, and square shoulders can be accurately duplicated on an engine lathe equipped with this control system, as shown in Fig. 1. All diameters and shoulders of a stepped shaft, for example, can be turned with one setting of the tool. The high degree of accuracy with which work of this kind can be handled is made possible by using the air control system as an amplifier of the slightest movement imparted to the stylus *A*, Fig. 2, by the thin metal templet *B*. This amplified movement of the stylus exercises pneumatic control over the hydraulic system, which, in turn, simultaneously transmits to the tool the longitudinal and crosswise feeding movements necessary for machining the work to the contour of the templet.

The motion imparted to the hydraulic pilot is from twenty-five to one hundred times greater than the motion of the stylus, depending upon the spring used in the hydraulic pilot valve assembly. A soft metal templet can be used, since a fully balanced air pilot valve permits satisfactory operation of the tracer stylus with a pressure or force as low as 3 to 8 ounces.

The tracer design, which is based on the regulation of an air flow to create a back pressure, permits of minute adjustments in a few thousandths of a second. Thus, the principle is the same as that used by precision air measuring gages, except that the air flow is regulated by the position of the stylus instead of by the size of the piece being measured.

While it is possible to apply the contour control to various machine tools, its use at present is limited to lathes and vertical boring mills. The method of applying it to an engine lathe to automatically provide the cross-slide and the carriage movements required for form-turning is shown diagrammatically in Fig. 3. As the spring-loaded

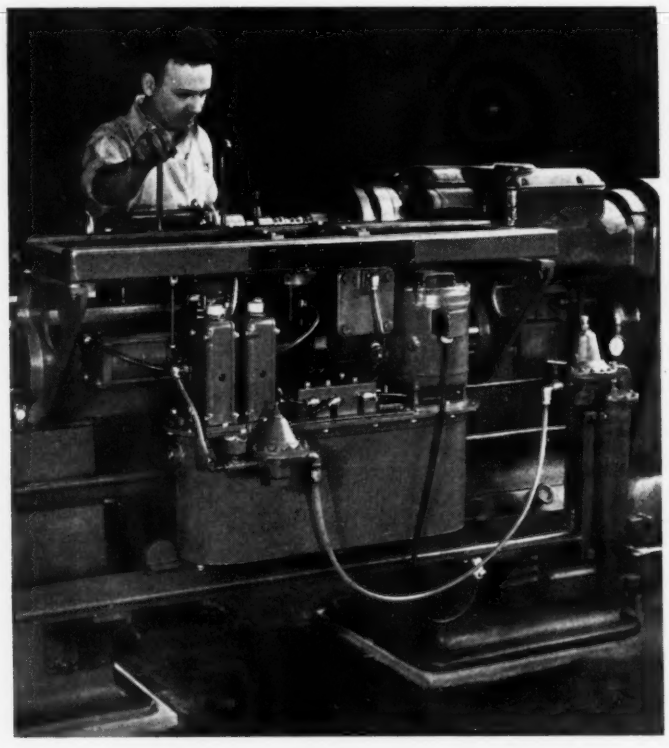


Fig. 1. Bailey Contour Control Installed on a Hendey Lathe for Automatic Form-turning of Work Shown at W, Fig. 2

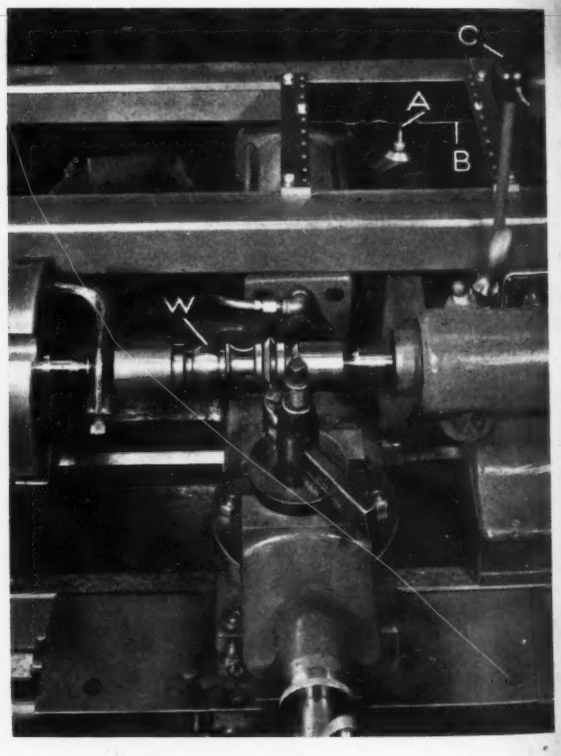
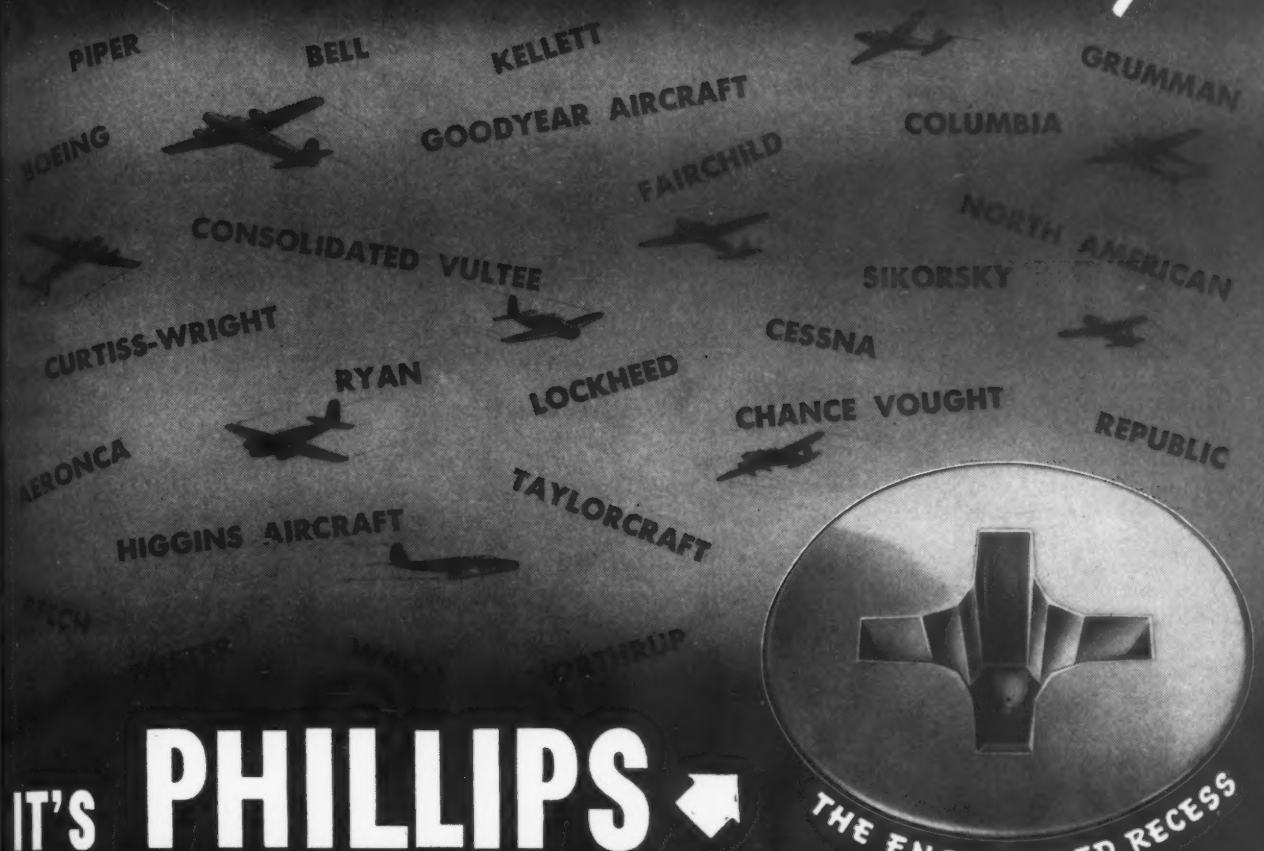


Fig. 2. View of Formed Work, Templet, Tracer, and One of Two Hand Controls C Used on the Lathe Shown in Fig. 1

Which RECESSED HEAD SCREW DOES THE AVIATION INDUSTRY *Okay?*



IT'S GOT TO BE RIGHT! The aviation industry knows its engineering . . . knows the answers to production efficiency. That's why most of the leaders in this industry selected the PHILLIPS Recessed Head.

You'll choose the Phillips Recess, too, once you study its exclusive design. You'll appreciate the scientific engineering that makes it so successful. You'll discover that every angle, every dimension has a purpose – is important to screw driving efficiency and screw strength. You'll agree there's nothing like it!

To end the screw driving troubles that slow down production and shove up assembly costs, specify screws with the Phillips Recessed Head. You can get them in any head style, type or size.

TO MAKE WARTIME QUOTAS AND PEACETIME PROFITS

FASTER STARTING: Driver point automatically centers in the Phillips Recess . . . fits snugly. Fumbling, wobbly starts, slant driving are eliminated. Work is made trouble-proof for green hands.

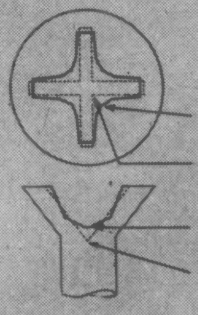
FASTER DRIVING: Spiral and power driving are made practical. Driver won't slip from recess to spoil material or injure worker. (Average time saving is 50%.)

EASIER DRIVING: Turning power is fully utilized. Workers maintain speed without tiring.

BETTER FASTENING: Screws are set-up uniformly tight, without burring or breaking of screw heads. The job is stronger, and the ornamental recess adds to appearance.

PHILLIPS *Recessed Head* SCREWS

WOOD SCREWS · MACHINE SCREWS · SELF TAPPING SCREWS · STOVE BOLTS



IDENTIFY IT!

Center corners of Phillips Recess are rounded . . .
NOT square.

Bottom of Phillips Recess is nearly flat . . .
NOT tapered to a sharp point.

23 SOURCES

American Screw Co., Providence, R. I.
The Bristol Co., Waterbury, Conn.
Central Screw Co., Chicago, Ill.
Chandler Products Corp., Cleveland, Ohio
Continental Screw Co., New Bedford, Mass.
The Corbin Screw Corp., New Britain, Conn.
General Screw Mfg. Co., Chicago, Ill.
The H. M. Harper Co., Chicago, Ill.
International Screw Co., Detroit, Mich.
The Lamson & Sessions Co., Cleveland, Ohio
Milford Rivet and Machine Co., Milford, Conn.
The National Screw & Mfg. Co., Cleveland, Ohio
New England Screw Co., Keene, N. H.
The Charles Parker Co., Meriden, Conn.
Parker-Kalon Corp., New York, N. Y.
Pawtucket Screw Co., Pawtucket, R. I.
Pheoll Manufacturing Co., Chicago, Ill.
Reading Screw Co., Norristown, Pa.
Russell Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Scovill Manufacturing Co., Waterville, Conn.
Shakeproof Inc., Chicago, Ill.
The Southington Hardware Mfg. Co., Southington, Conn.
Whitney Screw Corp., Nashua, N. H.

tracer or stylus follows the templet, the changes in contour tend to increase or decrease the air loading pressure in the air control system by changing the rate of flow from the air pilot nozzle. Air is supplied to the system from a constant-pressure source through an orifice of the proper size to maintain the loading pressure of 35 pounds per square inch when the tracer is in a neutral position. This air loading pressure controls both the contour pilot valve and the feed pilot valve.

Considering first the contour pilot valve, it will be noted that the air loading pressure is applied to the exterior of a flexible metal bellows, which contracts, forcing its housing against the spring until equilibrium is reached between the force of the spring and the force of the air pressure on the bellows. The bellows "breathes" during changes in air pressure, but is always balanced in a position corresponding to the air loading pressure. Since the oil pilot stem is attached to the free end of the bellows, it also moves up and down with changes in air pressure, always keeping in a position corresponding to the air loading pressure.

Let it be assumed that at the time the control is placed in operation the cutting tool is not in contact with the work, a condition in which the flow from the air pilot nozzle would be decreased by the tracer and the air loading pressure would increase above its neutral value of 35 pounds. The contour pilot valve of the hydraulic system would move up and open the rear of the cross cylinder to drain.

Hydraulic pressure in the front portion of the cylinder would then move the piston backward, carrying the cross-slide, tool, and tracer inward. This movement brings the stylus into contact with the templet and increases the flow of air from the air pilot nozzle; when the air loading pressure reaches its neutral value of 35 pounds, movement of the cross-slide stops. At the neutral air loading pressure of 35 pounds, the contour pilot valve has returned to its neutral position, as shown in the diagram, and has locked the cross-slide in a fixed position by applying hydraulic pressure equally to both sides of the power cylinder.

In actual operation, the air loading pressure does not vary appreciably from the 35-pound neutral value, since any tendency to depart from this pressure causes almost instantaneous movement of the cross-slide in the direction required to restore the neutral loading.

The rate of the longitudinal feed is controlled by the feed pilot valve, which, in effect, throttles the oil drain from the longitudinal power cylinder in accordance with the changes in air loading pressure. The maximum rate of drain from the cylinder, and, therefore, the maximum rate of feed, occurs when the air loading pressure is at the 35-pound neutral value. Either an increase or a decrease in the air loading pressure decreases the rate of feed. In fact, if the deviation from the neutral air loading pressure is sufficient, longitudinal feed is stopped altogether, as when facing.

Operation of both the feed pilot valve and the contour pilot valve in this manner from the same air loading pressure results in an even rate of feed. For example, the feed slows down when cutting a taper, and stops when a square shoulder is being machined. When the gage in the air loading pressure system indicates the neutral pressure of 35 pounds per square inch, the operator knows that the cutting tool is in the position required to reproduce the templet contour within the highest degree of accuracy. If the air loading pressure increases to 37 pounds or decreases to 33 pounds, the operator knows that the cutting tool is no longer in the position of extreme accuracy, but permits an error of 0.001 inch.

By using this precise continuous visual sizing method or "flying mike" effect, the operator can increase his rate of feed up to the allowed tolerance simply by watching the indicating gage on the air loading pressure. Adjustments for rate of feed and contouring action are provided, so that maximum production consistent with accuracy can be maintained.

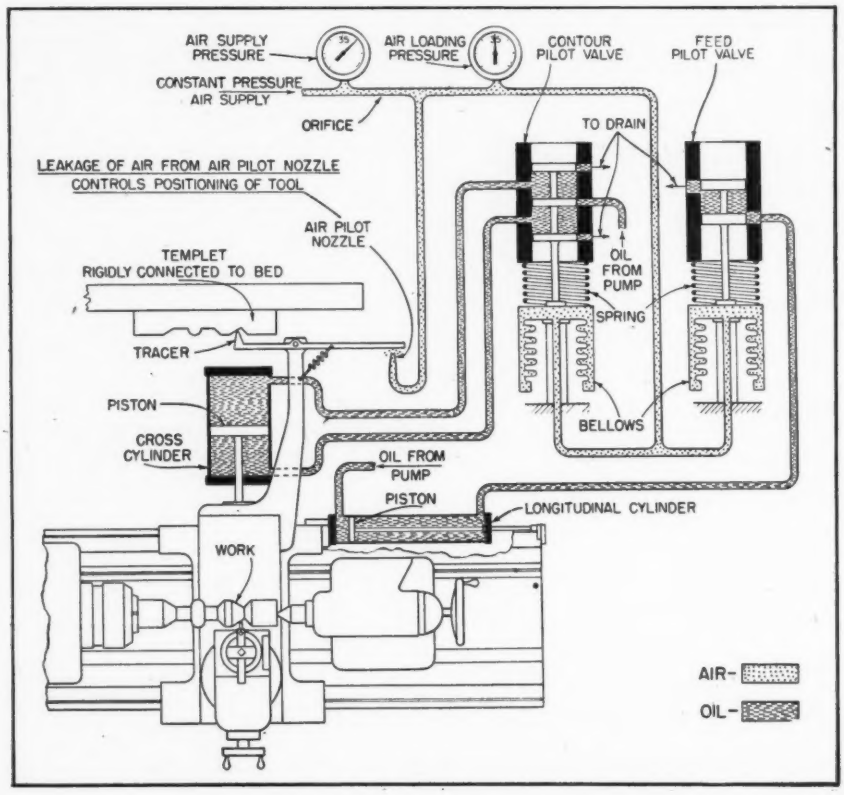
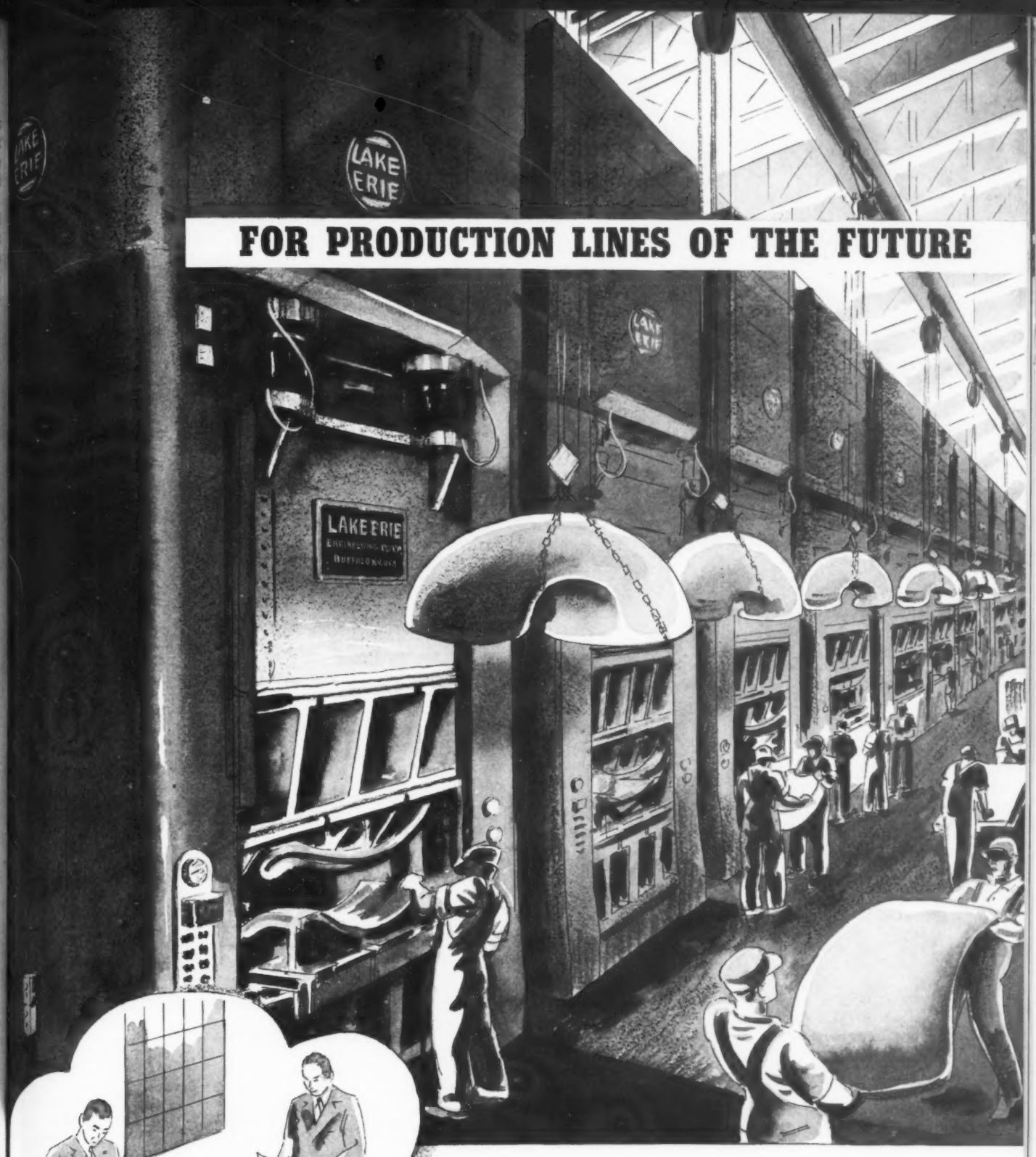


Fig. 3. Diagram of Pneumatically Controlled Hydraulic Contour Turning Equipment of Lathe Shown in Fig. 1

* * *

Rating Book for Foremen

An interesting booklet has been published by the Elliott Service Co., 219 E. 44th St., New York City. The booklet, called "Qualities of a 'Good Boss,'" contains a number of checking charts making possible a practical self-rating for people in supervisory positions.



FOR PRODUCTION LINES OF THE FUTURE

Production lines of tomorrow that exist only as blue prints today will include long lines of LAKE ERIE Hydraulic Presses that have proved their mettle during peacetime competition.

LAKE ERIE ENGINEERING CORPORATION • BUFFALO 17, NEW YORK

News of the Industry

California

PHILIP H. CLAPP has been appointed Abrasive Division district manager for the Pacific Coast by the Norton Co., Worcester, Mass. He will make his headquarters in Los Angeles, Calif. Mr. Clapp has been connected with the Norton Co. for thirty years, and since 1935 has been Abrasive Division district manager in Detroit. Prior to that, he was located in the California area. DONALD L. PRICE will succeed Mr. Clapp as Abrasive Division district manager in Detroit. He has been with the company for twenty-four years, and since 1926 has been field engineer and abrasive engineer in Detroit.

MOORE MACHINERY CO., Los Angeles, and San Francisco, Calif., has been appointed distributor for Tocco process induction heating and hardening equipment made by the OHIO CRANKSHAFT CO., Cleveland, Ohio. The Moore Machinery Co. will handle distribution of the equipment in the California, Nevada, and Arizona territories.

E. B. SCOTT has been promoted to the position of sales manager of the Engine Division of the Enterprise Engine & Foundry Co., 660 Florida St., San Francisco, Calif., builder of Diesel engines. He was formerly manager of the Repair and Maintenance Division, and assistant to the vice-president.

KENNAMETAL, INC., Latrobe, Pa., manufacturer of cemented-carbide cutting tools and blanks, announces the opening of a branch office at 378 Fifth St., San Francisco 7, Calif., with George Dolan in charge. Sales representation of Kennametal products by the WALTER R. CARR CO. has been discontinued.

Illinois and Indiana

HENRY E. HERMANN has been appointed works manager in charge of all production of the Bear Mfg. Co., Rock Island, Ill., manufacturer of precision balancing machines. L. B. ARP, who has served as production manager in addition to handling purchasing and personnel, will hereafter devote his entire time to his duties as director of purchases and personnel.

W. G. MCFADDEN, formerly assistant district sales manager of the Allegheny Ludlum Steel Corporation's Chicago office, has been appointed district manager of that territory.

David A. Coleman, Newly Elected Vice-president of Lake Shore Tool Works

DAVID A. COLEMAN has been elected vice-president of the Lake Shore Tool Works, Inc., of Chicago, manufacturers of high-speed steel and carbide production tools. He has held the positions of personnel manager, production manager and sales manager of the company.

HOWARD HALL and JAMES E. SWEENEY were elected directors of Kropp Forge Co., and Kropp Forge Aviation Co., 5301 W. Roosevelt Road, Chicago, Ill., at the recent annual meeting of these concerns. Mr. Sweeney, who is works manager of the Kropp Forge Co., was also made a vice-president. RAYMOND T. O'KEEFE, JR., director of industrial relations, was made a vice-president of the Kropp Forge Aviation Co.

NEIL C. HURLEY was elected chairman of the board of directors and NEIL C. HURLEY, JR., president of the Independent Pneumatic Tool Co., Chicago, Ill., at the annual meeting of the company.

LOGANSPORT MACHINE CO., INC., Logansport, Ind., manufacturer of hydraulic and air-operated chucks, presses, cylinders, valves, pumps, and other machine tool equipment, announces the appointment of the RUDEL MACHINERY CO., INC., 100 E. 42nd St., New York 17, N. Y., and 7 S. Main St., West Hartford 7, Conn., as representative of the company, succeeding FRANK G. KERNAN. C. G. WILSON, 4409 Druid Lane, Dallas, Tex., has been assigned the Tulsa, Okla., territory, in addition to the Texas territory previously handled.

Michigan

CROSS GEAR & MACHINE CO., Detroit, Mich., announces that the firm name has been changed to the CROSS CO. This change has been made because it was felt that the old name no longer describes the expanding Cross service to industry—a service that includes the designing, building, and installing of special machine tools to perform a variety of metal-cutting operations automatically. The management, policies, and personnel of the company will remain the same.

BERT CONWAY has been named vice-president in charge of manufacturing of the Aviation Corporation, 1333 Alexis Road, Toledo 1, Ohio. Since last April he has been manufacturing coordinator, acting as production and tooling adviser at all the manufacturing plants of the corporation. His headquarters will be in Detroit at the Federal Ave. plant of Republic Aircraft Products, a division of the Aviation Corporation.

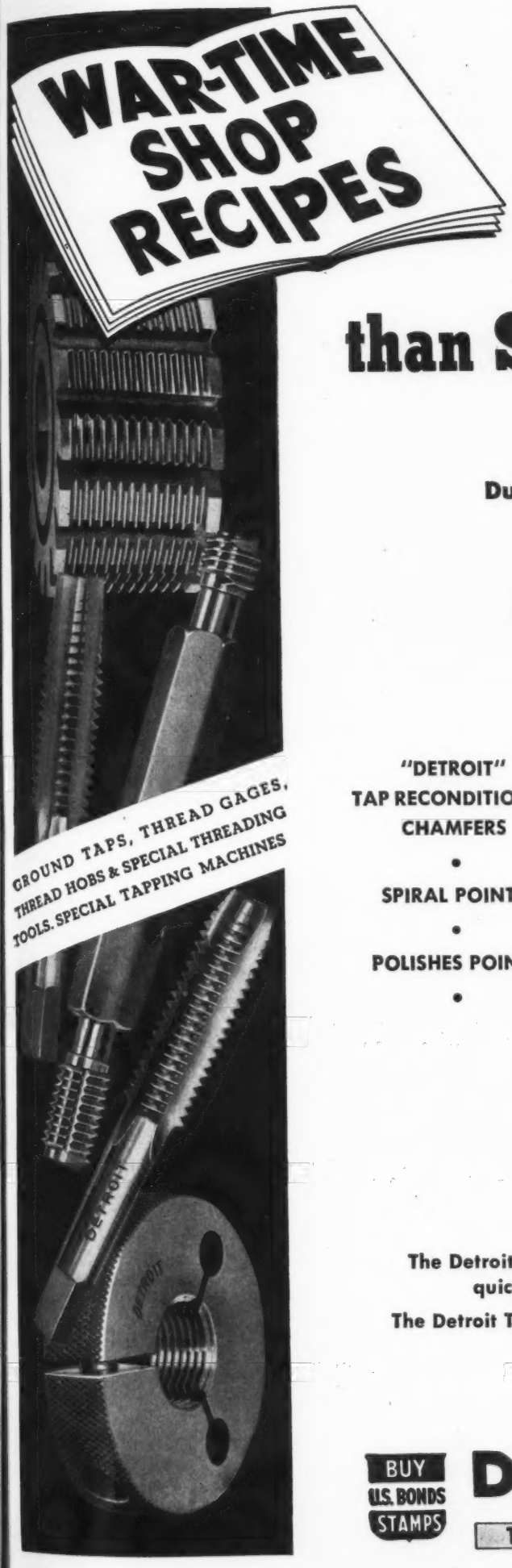
ABRASIVE DRESSING TOOL CO., Detroit, Mich., manufacturer of Red Band diamond tools, announces that it has opened a diamond wheel department and is now able to offer for immediate delivery a standard line of diamond wheels designed for the fast cutting of carbides.

A. H. FREEMAN has recently been appointed representative of the American Foundry Equipment Co., Mishawaka, Ind., in the Detroit territory, filling the post vacated by the death of M. T. Mortensen.

C. B. ALLEN, application engineer for the Reliance Electric & Engineering Co., Cleveland, Ohio, has been transferred from the Washington to the Detroit district.

WILLEY'S CARBIDE TOOL CO., 1340 W. Vernor Highway, Detroit, Mich., is now occupying a new addition to the company's plant, which more than triples the original size of the plant.

H. S. RUDESILL, for many years sales representative in the Detroit office of



DULL TAPS COST *MORE* than SHARP ONES

Dull taps wear out quicker
Dull taps increase scrap
Dull taps decrease thread accuracy

"DETROIT"
TAP RECONDITIONER
CHAMFERS
•
SPIRAL POINTS
•
POLISHES POINTS
•

The Detroit Tap Reconditioner makes it easy to keep taps sharp, quickly pays for itself, cuts tapping and tap costs.

The Detroit Tap Reconditioner puts you in a better position to meet tomorrow's stiff post-war competition.

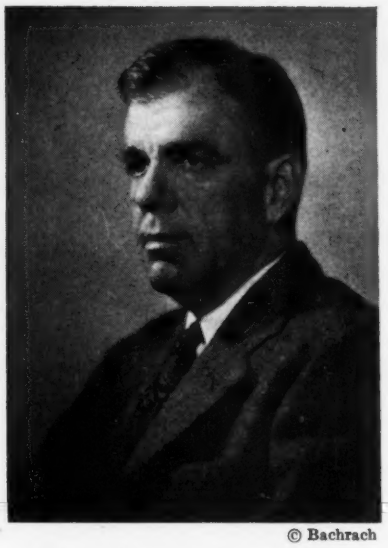
Ask for Bulletin No. TRM-2

BUY U.S. BONDS STAMPS

DETROIT TAP & TOOL CO.

8432 BUTLER
DETROIT 11,
MICH., U.S.A.

Charles W. Olsen, Who is Retiring as District Manager at Hartford of the Carpenter Steel Co.



© Bachrach

Wynn F. Rossiter, Who Succeeds Mr. Olsen as Hartford District Manager of the Carpenter Steel Co.

the Rustless Iron & Steel Corporation, Baltimore 13, Md., has been appointed district manager.

L. P. JACKSON, vice-president in charge of engineering, Mid-West Abrasive Co., Detroit, Mich., was elected a director of the firm at the recent annual meeting of stockholders.

New England

RICHARD F. V. STANTON has been appointed assistant manager of the machinery sales department of the Niles-Bement-Pond Co., West Hartford, Conn. Mr. Stanton has been with the company continuously since 1917, except for active war service in 1918. During the present war emergency, he has been in charge of the company's outside contracting. Now that this part of the program is virtually finished, he returns to the sales department as assistant manager.

Richard F. V. Stanton, Assistant Manager, Machinery Sales Department, Niles-Bement-Pond Co.

CHARLES W. OLSEN, for thirty-three years district manager for the Carpenter Steel Co. at Hartford, Conn., retired on March 1 after forty-nine years of active service with the company. Mr. Olsen is succeeded by WYNN F. ROSSITER, who has been associated with him for twenty years on the New England staff of the company.

CHARLES L. TOLLES was elected president of the Jewell Belt Hook Co., Naugatuck, Conn., at a recent meeting of the board of directors.

EDWARD R. WOLFERT, manager of engineering, Westinghouse Electric Appliance Division, East Springfield, Mass., and ALFRED L. ATHERTON, manager of quality control at the same plant, have been awarded the Westinghouse Order of Merit. Each received a large bronze medal bearing on its face a silver "W," together with the recipient's name. The Order, which is the highest honor conferred on employes of the Westinghouse company, is awarded for outstanding contributions to the electrical and mechanical arts and to company progress.

CHARLES SCHWARZLER, formerly manager of the Sales Promotion Department, has been appointed manager of the Export Department of the Foxboro Co., Foxboro, Mass., maker of industrial measuring, recording, and controlling instruments.

New Jersey

LLOYD C. SMITH, for thirty-two years associated with the Nicholson File Co., Providence, R. I., has become connected with Heller Brothers Co., Newark, N. J., in a sales capacity. For the last seven years, Mr. Smith has held the post of sales representative in the New York metropolitan area for the Nicholson organization. He will make his headquarters at the main offices of Heller Brothers in Newark.

ROOS TOOL & MFG. CO., manufacturer of wire-drawing die machinery, lapping machines, drilling machines, grinders, and polishing lathes, has moved from Bloomfield, N. J., into a new plant at 17-19 Grove St., Montclair, N. J. The new plant consists of a two-story building containing 11,000 square feet of floor space.

LYMAN D. WARNER has been appointed sales manager of the Crocker-Wheeler Division of the Joshua Hendy Iron Works, Ampere, N. J. He has been assistant sales manager since 1941.

New York

GERALD A. LUX has joined the technical staff of Oakite Products, Inc., 22 Thames St., New York 6, N. Y. For the last two years he has been a research associate of the American Electroplaters' Society at the National Bureau of Standards, and has had many years of experience as a development engineer, chemist, and research director in connection with metallurgical and chemical problems involving the

Gerald A. Lux, Who Recently Joined the Technical Staff of Oakite Products, Inc.

MACHINERY'S DATA SHEETS 511 and 512

SIZES AND PROPERTIES OF STANDARD PIPE—1

Welded and Seamless Wrought-Iron and Wrought-Steel Pipe—Schedule 40, American Standards Association B-36-10

Diameter, Inches			Wall Thickness, Inches	Area, Square Inches			Circumference, Inches		Weight per Foot, Pounds			Threads per Inch	Normal Engagement by Hand of Thread, Inches	Tap Drill Size, Inches
Nominal	Actual Inside	Actual Outside		Of Circle with Outside Diameter	Of Circle with Inside Diameter	Cross-Section of Metal	Outside	Inside	Of Pipe	Of Water in Pipe	Of Pipe and Water			
1/8	0.269	0.405	0.068	0.12	0.0569	0.072	1.27	0.84	0.25	0.028	0.278	27	0.180	11/32
1/4	0.364	0.540	0.088	0.22	0.1041	0.125	1.69	1.14	0.43	0.045	0.475	18	0.200	7/16
3/8	0.493	0.675	0.091	0.35	0.1909	0.167	2.12	1.55	0.57	0.083	0.653	18	0.240	37/64
1/2	0.622	0.840	0.109	0.55	0.3039	0.250	2.65	1.95	0.86	0.132	0.992	14	0.320	45/64
3/4	0.824	1.050	0.113	0.86	0.5333	0.333	3.29	2.58	1.14	0.232	1.372	14	0.340	29/32
1	1.049	1.315	0.133	1.35	0.8639	0.494	4.13	3.29	1.68	0.375	2.055	11 1/2	0.400	1 9/64
1 1/4	1.380	1.660	0.140	2.16	1.4950	0.669	5.21	4.33	2.28	0.649	2.929	11 1/2	0.420	1 1/2
1 1/2	1.610	1.900	0.145	2.83	2.0360	0.799	5.96	5.06	2.72	0.882	3.602	11 1/2	0.420	1 23/32
2	2.067	2.375	0.154	4.43	3.3560	1.075	7.46	6.49	3.66	1.454	5.114	11 1/2	0.440	2 3/16
2 1/2	2.469	2.875	0.203	6.49	4.7880	1.704	9.03	7.75	5.80	2.073	7.873	8	0.680	2 11/16
3	3.068	3.500	0.216	9.62	7.3930	2.228	10.96	9.63	7.58	3.201	10.781	8	0.770	3 5/16
3 1/2	3.548	4.000	0.226	12.56	9.8880	2.680	12.56	11.14	9.11	4.287	13.397	8	0.820	3 13/16
4	4.026	4.500	0.237	15.30	12.7300	3.173	14.13	12.64	10.80	5.516	16.316	8	0.850	4 5/16
5	5.047	5.563	0.258	24.29	20.0100	4.304	17.47	15.84	14.70	8.674	23.374	8	0.940	5 3/8
6	6.065	6.625	0.280	34.47	28.8900	5.584	20.81	19.05	19.00	12.520	31.520	8	0.960	6 7/16
8	7.981	8.625	0.322	58.42	50.0300	8.396	27.09	25.07	28.60	21.680	50.280	8	1.060	8 7/16
10	10.020	10.750	0.365	90.79	78.8500	11.900	33.77	31.47	40.50	34.160	74.660	8	1.210	10 9/16
12	11.938	12.750	0.406	127.67	113.0900	15.770	40.05	37.70	53.60	48.500	102.100	8	1.360	12 9/16
14	13.126	14.000	0.437	176.71	135.3200	18.610	47.12	44.76	63.30	58.640	121.940	8	1.560	13 13/16
16	15.000	16.000	0.500	226.98	176.7200	24.350	53.41	51.52	82.80	76.580	159.380	8	1.810	15 13/16
18	16.876	18.000	0.562	254.47	223.6800	30.790	56.55	53.00	105.00	96.930	201.930	8	2.000	17 13/16
20	18.814	20.000	0.593	314.16	278.0000	36.150	62.83	59.09	123.00	120.460	243.460	8	2.125	19 13/16
24	22.626	24.000	0.687	452.39	402.0700	50.310	75.40	71.07	171.00	174.230	345.230	8	2.375	23 13/16

SIZES AND PROPERTIES OF STANDARD PIPE—2

Welded and Seamless Wrought-Iron and Wrought-Steel Pipe—Schedule 40, American Standards Association B-36-10

Nominal Diameter, Inches	Properties				Length of Pipe per Square Foot of Surface		Square Feet of Surface per Foot of Pipe		Capacity of Pipe per Foot of Length			Length of Pipe in Feet to Contain	
	Moment of Inertia	Radius of Gyration	Section Modulus	Torsion Section Modulus	Outside, Feet	Inside, Feet	Outside, Sq. Feet	Inside Sq. Feet	In Cubic Inches	In Cubic Feet	In Gallons	One Cubic Foot	One Gallon
1/8	0.001064	0.120	0.0052	0.0104	9.431	14.15	0.106	0.070	0.67	0.00039	0.003	2533.775	338.740
1/4	0.003312	0.160	0.0122	0.0243	7.073	10.50	0.141	0.095	1.24	0.00072	0.005	1383.789	185.000
3/8	0.007291	0.210	0.0216	0.0433	5.658	7.67	0.177	0.129	2.25	0.00130	0.010	754.360	100.850
1/2	0.01709	0.260	0.0478	0.0956	4.547	6.13	0.221	0.167	3.63	0.00210	0.016	473.906	63.356
3/4	0.03704	0.330	0.0717	0.1435	3.637	4.63	0.275	0.215	6.39	0.00370	0.028	270.034	36.100
1	0.08734	0.420	0.1300	0.2600	2.904	3.67	0.344	0.274	10.71	0.00620	0.045	166.618	22.275
1 1/4	0.1947	0.540	0.2300	0.4600	2.301	2.76	0.435	0.361	17.97	0.01040	0.077	96.275	12.871
1 1/2	0.3099	0.620	0.3320	0.6630	2.010	2.37	0.497	0.422	24.36	0.01410	0.106	70.733	9.456
2	0.6660	0.787	0.5490	1.0980	1.608	1.84	0.622	0.540	40.26	0.02330	0.174	42.913	5.737
2 1/2	1.530	0.947	1.0250	2.0500	1.328	1.54	0.753	0.654	57.37	0.03320	0.248	30.077	4.021
3	3.017	1.164	1.7350	3.4700	1.091	1.24	0.916	0.803	88.82	0.05140	0.383	19.479	2.604
3 1/2	4.788	1.337	2.4000	4.8000	0.954	1.07	1.047	0.928	117.85	0.06820	0.513	14.565	1.947
4	7.233	1.510	3.5350	7.0700	0.848	0.94	1.178	1.052	152.76	0.08840	0.660	11.312	1.512
5	15.160	1.878	5.4100	10.8200	0.686	0.75	1.456	1.319	236.46	0.13900	1.040	7.198	0.962
6	28.140	2.245	8.6250	17.2500	0.576	0.63	1.734	1.585	347.33	0.20100	1.500	4.984	0.666
8	72.490	2.938	15.9100	31.8200	0.443	0.47	2.258	2.090	601.34	0.34800	2.600	2.878	0.384
10	160.70	3.674	23.4000	46.8000	0.355	0.38	2.814	2.622	945.22	0.54700	4.100	1.826	0.244
12	300.30	4.370	46.2500	92.5000	0.299	0.32	3.370	3.140	1356.48	0.78500	5.870	1.273	0.170
14	429.10	4.800	62.1000	124.2000	0.250	0.27	3.930	3.722	1847.23	1.06900	7.030	1.067	0.142
16	731.90	5.470	92.6000	185.2000	0.220	0.23	4.440	4.310	2405.38	1.39200	9.180	0.814	0.109
18	1172.0	6.180	131.5000	263.0000	0.210	0.22	4.712	4.420	2683.58	1.55300	11.120	0.644	0.086
20	1703.0	6.870	172.0000	344.0000	0.190	0.20	5.236	4.920	3326.40	1.92500	14.400	0.517	0.069
24	3424.0	8.250	284.0000	568.0000	0.160	0.17	6.283	5.920	4838.40	2.80000	20.900	0.357	0.048

use of alkaline and related cleaning compounds. Mr. Lux will devote a large part of his time to field work in an advisory capacity, and in addition, will conduct research studies on metal surface preparation and finishes.

CHARLES W. SPRENGER has been appointed district manager of the metropolitan New York district for the Carborundum Co., Niagara Falls, N. Y., succeeding the late John Storm. Mr. Sprenger's headquarters will be at the company's New York warehouse and sales office located at 601 W. 26th St., Starrett-Lehigh Building. Announcement is also made of the appointment of JOSEPH C. STEELE as district sales office manager at New York, succeeding E. W. MARTIN, who has been named regional sales office manager of the eastern sales districts of the company.

BRUNO R. NEUMANN, until recently senior economist with the Planning Division of the War Production Board, has joined the National Foremen's Institute, Inc., Deep River, Conn., as labor economist and editorial director. He will make his headquarters at the company's editorial office, 527 Fifth Ave., New York City.

INDUSTRIAL EQUIPMENT CO., 170 Franklin St., Buffalo, N. Y., formerly the R. C. NEAL Co., has been appointed sales representative for the products made by the TOMKINS-JOHNSON Co., Jackson, Mich., which include air and hydraulic cylinders, "Rivitors," and "Clinchors."

WILLIAM C. MOODIE has been elected president of the Calculagraph Co., New York City, manufacturer of timing devices and other instruments. He succeeds the late Henry Abbott, who founded the company fifty-two years ago. HAROLD B. THOMAS has been elected treasurer and a director.

ALTON PARKER HALL has been appointed assistant general manager of sales of the American Chain & Cable Co., Inc., Bridgeport, Conn. He will have headquarters at 230 Park Ave., New York City.

FITCHBURG GRINDING MACHINE CORPORATION, Fitchburg, Mass., has appointed the RUDEL MACHINERY CO., INC., of New York, Hartford, and Boston, exclusive representative of the corporation in the New York and New England territories.

DUFF-NORTON MFG. CO., Pittsburgh, Pa., manufacturer of industrial jacks, announces the removal of its eastern district offices from the Empire State Building to 250 Park Ave., New York City. GEORGE L. MAYER is New York district manager.

Ohio

WILLIAM F. GROENE, vice-president and chief engineer of the R. K. LeBlond Machine Tool Co., Cincinnati, Ohio, retired on January 29. Previous to starting with the organization, Mr. Groene operated a small jobbing shop in downtown Cincinnati. He has been responsible for many developments in machine tools, holding over one hundred and thirty patents jointly and in his own name. He has an international reputation for the design and improvement of machines for the rapid and accurate production of crankshafts. In 1940, the National Association of Manufacturers awarded him a medal and scroll as "A modern pioneer of the frontier of American industry, in recognition of distinguished achievement in the field of science and invention which has advanced the American standard of living."

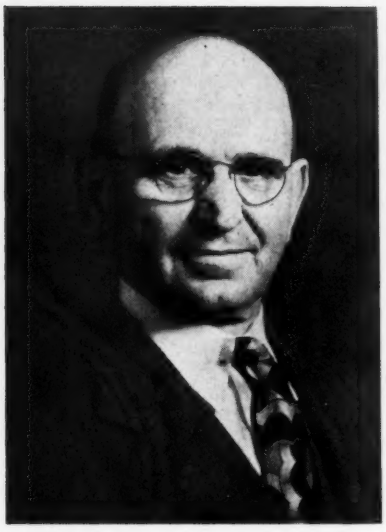
HAROLD J. SIEKMANN succeeds Mr. Groene as chief engineer. Mr. Siekmann joined the LeBlond organization in June, 1910. After a four-year apprenticeship he was placed in the engineering department, where he has remained since, with the exception of an interval in 1917 and 1918, when he was in Government service, and several years in the LeBlond sales department in California and Cleveland, Ohio. Mr. Siekmann has been closely associated with Mr. Groene in the development of LeBlond products.

PAUL M. SNYDER has been appointed sales manager of the Climax Molybdenum Co., with headquarters in Canton, Ohio. He joined the company as a metallurgical engineer in March, 1932, and since that time has been in charge of sales and development work in the Canton area. Prior to joining the Climax Molybdenum Co., he was assistant to the vice-president of the Republic Research Corporation.

AGA METAL TUBE CO., announces that the name of the company has been changed to AGALOY TUBING CO. and that the plant has been moved from Elizabeth, N. J., to Springfield, Ohio. E. Q. SMITH, formerly vice-president of the Bundy Tubing Co., Detroit, Mich., is president of the company.

William F. Groene, Who is Retiring as Vice-president and Chief Engineer of R. K. LeBlond Machine Tool Co.

Harold J. Siekmann, Who will Succeed Mr. Groene as Chief Engineer of R. K. LeBlond Machine Tool Co.



Anton Erhardt, New Plant Superintendent of National Tool Co.

ANTON ERHARDT has been appointed plant superintendent of the National Tool Co., Cleveland, Ohio, in charge of the company's production of precision metal-cutting tools. Mr. Erhardt started with the predecessor of the National Tool Co. thirty-six years ago as a punch press and lathe hand. Since 1927, he has devoted himself principally to the production and application of gear-cutting tools. For the last four years, he has been acting as field representative of the company.

JOHN P. BERNARD has been promoted to the position of vice-president and general manager of the Sheffield Corporation, Dayton, Ohio. Mr. Bernard joined the corporation in 1942 after being connected for seventeen years with the Dyer Co., Inc., Cleveland, Ohio, a well-known company in the industrial management and engineering field.

John P. Bernard, New Vice-president and General Manager, Sheffield Corporation

HARRY M. HECKATHORN has been elected vice-president in charge of production of the Mullins Mfg. Corporation's Salem and Warren, Ohio, plants. Mr. Heckathorn takes the place of HOWARD F. KULAS, vice-president in charge of operations at Salem, who is leaving because of ill health.

WILLIAM F. VOSMER, until recently an executive in the Steel Section of the War Production Board in Washington, has rejoined the Republic Steel Corporation, Cleveland, Ohio, as manager of railroad sales. He succeeds the late Emmett Conneely in this post.

DANIEL C. GREEN has been elected chairman of the board of the Cleveland Pneumatic Tool Co., and its subsidiary, Cleveland Pneumatic Aerol, Inc., Cleveland, Ohio, and GEORGE P. TORRENCE has been elected president.

A. D. ROBERTSON has been appointed assistant manager of the Motor Division of the Allis-Chalmers works at Norwood, Ohio.

Pennsylvania and Maryland

P. E. FLOYD, formerly sales manager of the Chicago district of the Allegheny Ludlum Steel Corporation, has been appointed assistant general manager of sales. Mr. Floyd returned recently from Washington, D. C., where he filled the post of chief of the Stainless Section of the Steel Division of the War Production Board. He will make his headquarters at the main offices of the company in Brackenridge, Pa.

JOHN F. ROBB has been appointed manager of the Pittsburgh district of the Climax Molybdenum Co., 500 Fifth Ave., New York City. Before joining the Climax technical staff in 1935, Mr. Robb was connected successively with the Carpenter Steel Co., the Birdsboro Steel Foundry & Machine Co., the Pittsburgh Crucible Steel Co., and the Brighton Electric Steel Casting Co.

ROBERT A. CAMPBELL, who has been associated with the marketing end of the steel tubing industry for nearly fifteen years, has been appointed sales manager of the Steel Tube Division of Talon, Inc., Oil City, Pa. Mr. Campbell has been connected with the Ohio Seamless Tube Co. at Shelby for the last seven years in the capacity of assistant sales manager.

J. H. Wood, Who has Joined Sales Staff of the Farquhar Hydraulic Press Division

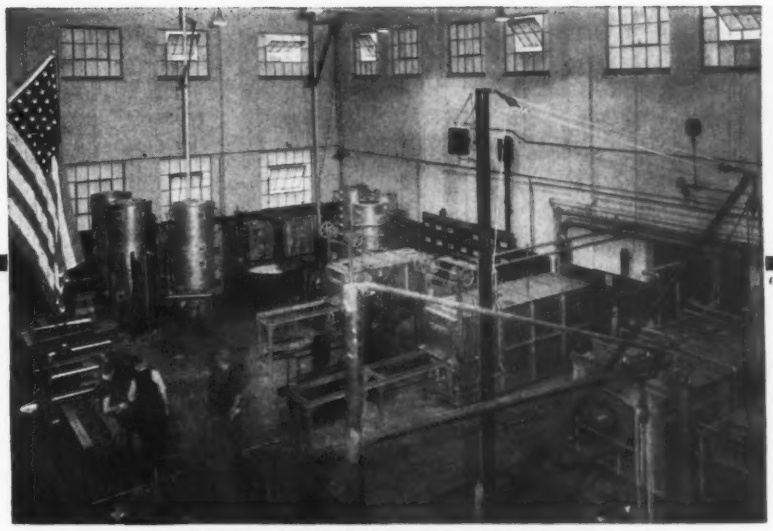
J. H. WOOD has joined the sales staff of the Hydraulic Press Division of the A. B. Farquhar Co., York, Pa. His territory will comprise the central coastline states, and his headquarters will be at Room 1033D, Broad St. Suburban Station Bldg., Philadelphia, Pa.

FRANK J. STANLEY has been appointed plant manager of the Lebanon Steel Foundry, Lebanon, Pa., succeeding HENRY D. PHILLIPS, who has resigned to accept a commission in the U. S. Navy. For the last four years, Mr. Stanley has been plant superintendent. Prior to becoming connected with the Lebanon organization, he had twenty-five years experience in operating steel foundries. L. G. MILLER will assume Mr. Stanley's former position of plant superintendent.

ELECTRIC SERVICE SUPPLIES CO., 17th and Cambria Sts., Philadelphia 32, Pa., announces that the name of the company has been changed to ELECTRIC SERVICE MFG. CO. The ownership and management of the company remain unchanged. A. H. ENGLUND, executive vice-president, was recently elected president, and J. R. MCFARLIN, electrical engineer, is now secretary.

HAROLD SPURGEON, of Henry Disston & Sons, Inc., Philadelphia, Pa., has been awarded what is known as the Distinguished Service Pin of the Chamberlain Co., manufacturers' representative, Los Angeles, Calif., for his cooperation with the Chamberlain Co. and the assistance that he has given to Chamberlain field engineers.

ANDREW H. KEAN has been appointed general manager of the Edward A. Lynch Machinery Co., Ardmore, Pa. Mr. Kean was previously connected



A corner of the Colonial Heat Treat Department.

How to get more out of your Broaches------

BY PROPER HEAT-TREAT

The difference between an ordinary broach and a really good one is frequently traceable to the heat-treatment before grinding. Of course, you can't take all your broaches and heat-treat them yourself for longer life. But you can make sure that they are properly heat-treated.

One of the best ways to do this is to check into your broach supplier's heat treating equipment.

As a starter, we will be glad to tell you about our new, modern and complete Heat Treat Department. It will give you an idea why Colonial Broaches do such an outstanding job.

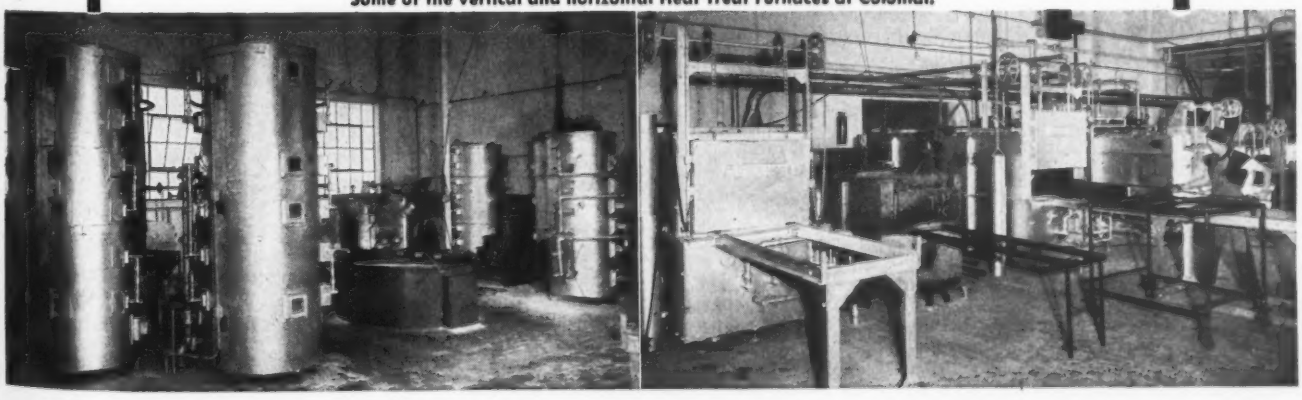
Ask for a copy of Broaching News—Vol. V, No. 2.

colonial BROACH COMPANY

DETROIT 13, U.S.A.

Broaches — Broaching Machines - Broaching Equipment

Some of the vertical and horizontal Heat Treat Furnaces at Colonial.



for twenty-eight years with the Bridgeport Safety Emery Wheel Co., of Bridgeport, Conn.

C. E. KRAEHN has been appointed assistant to V. H. Peterson, vice-president in charge of sales activities of the Baldwin Locomotive Works, Philadelphia, Pa. Mr. Kraehn joined the Baldwin organization last year after an association of twenty-four years with the General Electric Co.

JESSOP STEEL CO., Washington, Pa., announces that it has brought out a new line of cemented-carbide tipped tools, known as Malta, for cutting steel, cast iron, non-ferrous and non-metallic materials.

R. C. EDGAR has been appointed personnel director of the Allegheny Ludlum Steel Corporation, Brackenridge, Pa.

FRANK WOLF CO., 740 Sansom St., Philadelphia 6, Pa., manufacturer of precision tools and parts, announces that facilities are now available for the manufacture of production parts on a contract basis.

ARTHUR J. O'LEARY has been appointed assistant manager of sales of the Lukens Steel Co., Coatesville, Pa., and GEORGE W. ESHLEMAN has been made assistant to the manager of sales.

PANGBORN CORPORATION, Hagerstown, Md., was presented on March 4 with the National Security Award Certificate and Flag for outstanding achievement "above and beyond the line of duty prescribed by the U. S. Army, the District Ordnance Area, and the Regional Office of Civilian Defense." The presentation was made by Colonel Henry A. Reninger, acting regional director of the Third Civilian Defense Command of Baltimore, and accepted by Thomas W. Pangborn, president of the corporation. The Pangborn organization is the second in the state of Maryland to receive this award.

Wisconsin

GORDON K. TOLLAKSEN has been appointed purchasing agent of the Dumore Co., Racine, Wis., manufacturer of fractional-horsepower motors and portable precision tools. He succeeds J. M. HAMILTON. Mr. Tollaksen was previously assistant purchasing agent.

T. C. KNUDSEN has been made manager and chief engineer of the new Texrope department of the Allis-Chalmers Mfg. Co., Milwaukee, Wis. Mr. Knudsen has been with the company since 1922, and was formerly in the milling machinery department.

Obituaries

Charles E. Hahn

Charles E. Hahn, general manager of the Cincinnati Electrical Tool Co., Cincinnati, Ohio, a subsidiary of the R. K. LeBlond Machine Tool Co., died suddenly of a heart attack at his home on February 7. He was fifty-three years old. Mr. Hahn had been general manager of the Cincinnati Electrical Tool Co. for the last eight years. He became associated with the company in the capacity of salesman twenty years ago.

In charge of that division of the R. K. LeBlond Machine Tool Co. which manufactures electric drills, grinders, and buffers, as well as other special tools, Mr. Hahn was responsible for the shipment of this equipment to war centers in all parts of the world. The work of his division was early recognized by the Army and Navy when, on September 8, 1942, the Cincinnati Electrical Tool Co. was awarded the Army-Navy "E" for "excellence in production." Mr. Hahn was widely known in the metal-working field, and his sudden passing will be mourned by friends and acquaintances the country over.

Niels A. Sorensen

Niels A. Sorensen, superintendent of the Automotive and Diesel Crankshaft Division of the Ohio Crankshaft Co., Cleveland, Ohio, died on March 7 of burns suffered when a gas heater exploded in his home. He had been connected with the Ohio Crankshaft Co. since 1937.

Mr. Sorensen was born in Copenhagen, Denmark, in 1881, and came to this country when he was twenty years old. His first machine tool training was obtained in Detroit. Later he went to Cleveland, where he was connected with the Grant-Lee Gear Co., the Chandler Motor Car Co., and the Hupp Motor Co. He was general manager of the Crankshaft Division of the latter concern in Fostoria, Ohio.

National recognition was accorded Mr. Sorensen last year for perfecting a method of removing broken drills from crankshafts by the use of a small quantity of dynamite.

Jesse Jay Ricks

Jesse Jay Ricks, chairman of the board of Union Carbide and Carbon Corporation, New York City, died at his home in Plandome, N. Y., on February 20, after a brief illness. He was sixty-four years of age. Mr. Ricks became chairman of the board of Union Carbide and Carbon Corporation in 1941. He had been president from October, 1925, to May, 1941.

Mr. Ricks was born in Taylorville, Ill., in 1879. He received his early education in the local public schools, and was graduated from the University of Michigan with the degree of Bachelor of Philosophy in 1901. The Michigan Law School awarded him the degree of Bachelor of Laws in 1903. Mr. Ricks practiced law for several years before he joined Union Carbide and Carbon Corporation.

Coming Events

APRIL 5-7—Aeronautic Meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Hotel New Yorker, New York City. John A. C. Warner, secretary and general manager, 29 W. 39th St., New York City.

APRIL 25-28—THIRD WAR PRODUCTION FOUNDRY CONGRESS AND FOUNDRY SHOW of the American Foundrymen's Association, to be held at the Memorial Auditorium, Buffalo, N. Y., in conjunction with the forty-eighth annual meeting of the Association. Executive office, American Foundrymen's Association, 222 W. Adams St., Chicago, Ill.

MAY 1-2—WESTINGHOUSE MACHINE TOOL ELECTRIFICATION FORUM to be held at the William Penn Hotel, Pittsburgh, Pa., under the auspices of the Westinghouse Electric & Mfg. Co., Pittsburgh, Pa.

MAY 22-24—Twenty-eighth annual meeting of the AMERICAN GEAR MANUFACTURERS ASSOCIATION at the Westchester Country Club, Rye, N. Y. Newbold C. Goin, executive secretary, Empire Bldg., Pittsburgh 22, Pa.

"Simplified Printmaking"—explained

A comparison will help do this quickly.

You probably are familiar with blueprinting—with its water and potash baths, driers, plumbing connections, and multiple controls.

In an Ozalid machine all of these are eliminated. Printmaking is simplified. You turn out whiteprints of your engineering drawings, charts, letters in one continuous operation which incorporates EXPOSURE and DRY DEVELOPMENT.

OZALID DRY DEVELOPMENT is the *big difference* when you compare processes.

It is responsible for the exclusive "printmaking extras" you receive . . . for compact machine design . . . and the fact that the operator can be you or anyone.

Facts About "Simplified Printmaking":

1. You can use a complete line of papers, cloths, and foils—an impossibility with "wet" or "semi-dry" methods.

With Ozalid you can produce prints having black, blue, or maroon lines on a white background.

You can make transparent duplicates which may be used . . . in place of valuable originals in subsequent print production . . . or by draftsmen to save time when making design changes.

And you can reclaim soiled or worn originals by making foil duplicates.

2. You process all Ozalid materials in the same manner. No solutions to change. No "stops" in production.

3. You can use cut sheets as well as roll stock . . . thus you can eliminate trimming waste by ordering materials the size of your originals.

How to Save Time, Labor, and Materials

If you have already installed expensive blueprinting equipment, you can add an Ozalid Dry Developing unit which, when used with your present printer, will give you all of Ozalid's advantages.

If you're being slowed down by inadequate equipment, order an Ozalid Whiteprint machine. There's one for every production requirement. You can rely on it for all your printmaking.

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Classified Contents of This Number

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